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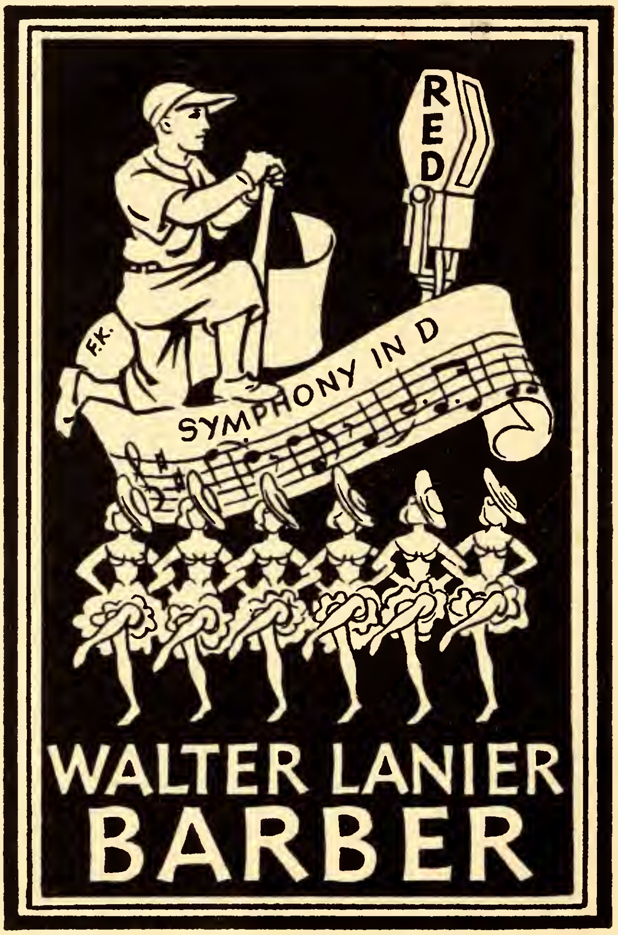
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CROSS-COUNTRY
Techniques
ILLUSTRATED

by DON CANHAM

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Track Coach, University of Michigan

Designed and Illustrated
by TYLER MICOLEAU

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Dedicated
to
The University of Michigan
Distance Runners
Past, Present and
Future

INTRODUCTION

Cross-country running goes as far back in the history of the human race as almost any activity we know. We can visualize the cave man running over the hills and plains in search of food or to safety from preying enemies. Mobility of ancient armies originally depended upon their ability to run with their weapons, and the first competition over "hills and dales" no doubt took place on an informal basis between the cave men or the ancient soldiers.

The resourceful English were the first to place the sport of long-distance running across the country on a highly competitive basis. In fact, the now famous "crick run" of *Tom Brown's School Days* was first recorded as taking place about 1837.

It is interesting to note that in England the first teams were fielded by the colleges, but they soon lost interest. Athletic clubs took over and pushed the sport to its current European popularity.

In America, just the opposite took place. The clubs, such as the Westchester Hares and Hounds Club and the New York American Athletic Harriers, were running over the hills in the 1870's. A short time later, hundreds of clubs sprang up throughout the east on a recreational "hares and hounds" basis. While club athletes were enthusiastic about cross-country running, the officials who controlled the purse strings were not. Due to a lack of finances, club cross-country running began to disappear.

It remained for Harvard University (the first college to start the sport seriously on a "hares and hounds" basis) in the 1880's to show an interest in, and the advantages of, cross-country running. The first intercollegiate cross-country race, however, was run in 1890 between Pennsylvania and Cornell. Since that meet, cross-country running has enjoyed a steady increase in popularity. Now, virtually every college in the nation takes part in some form of fall cross-country running, and literally thousands of our high schools run in regular competition. In addition, many athletic clubs have again fielded teams. Cross-country running is here to stay, and each fall more and more young men are experiencing the thrills and satisfaction of competing against their opponents, the terrain, and very often, the elements.

This wonderful fall sport has much to offer the young men who take part, for it is not only an enjoyable activity, but is fundamentally sound in total development—mental and physical. In addition, cross-country running provides activity and competition for all types of boys. It is remarkable that so many young men who have had little success in other sports, including track and field, have found a place in the cross-country programs. This is true because there is no other sport or activity where sheer determination, hard work and devotion to the job at hand pay such great dividends. Without doubt the great and near great cross-country runners are *made* and *not born.*

The author offers this text to the young men of courage and determination who aspire to succeed as cross-country and distance runners. Master the technique well, be patient, conscientious and, above all, *develop* a tenacious desire to improve from week to week and month to month.

This text was made possible through the contributions made by several individuals. The late E. C. "Billy" Hayes* will always be credited with giving America a new concept of distance running, and because of his great vision there is very little new under the distance-running sun.

Ken Doherty of Pennsylvania and Dr. Sid Robinson of Indiana have contributed more than any others to the author's background. In addition, Phil Diamond, who helped organize "Track Techniques Illustrated" and "Field Event Techniques Illustrated" of this series, also did a yeoman's job on this text. George Dales, track coach at Western Michigan College, provided a great deal of detailed research. In addition, Len Paddock, Michigan track trainer, and Elmer Swanson, the author's assistant, have aided with certain research.

* "Billy" Hayes coached at Indiana from 1924 to 1943, when he died.

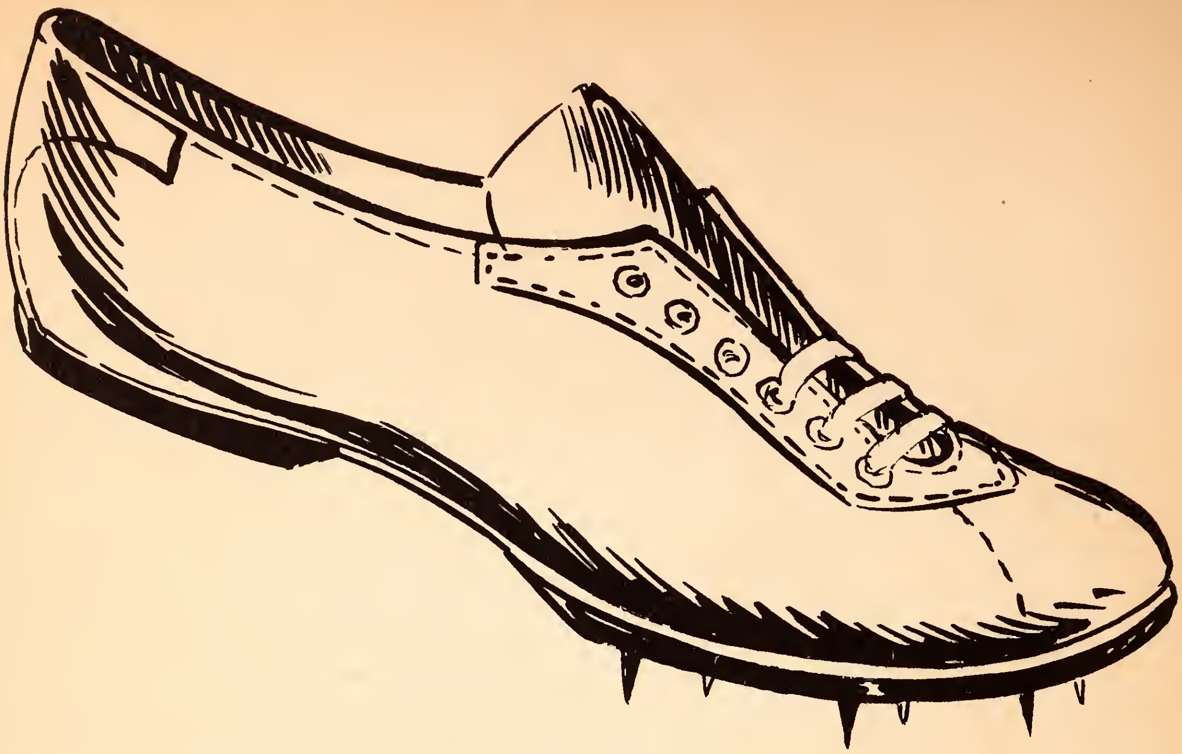
Chapter I

EQUIPMENT AND THE COURSE

The cross-country runner requires more personal equipment than any other track and field athlete. Due to the fact that he is required to run over various surfaces and often under the worst of climatic conditions, several equipment precautions must be taken for his safety and comfort. Fortunately, his equipment is neither complex nor expensive. It may, however, be a great contributing factor toward his success or failure.

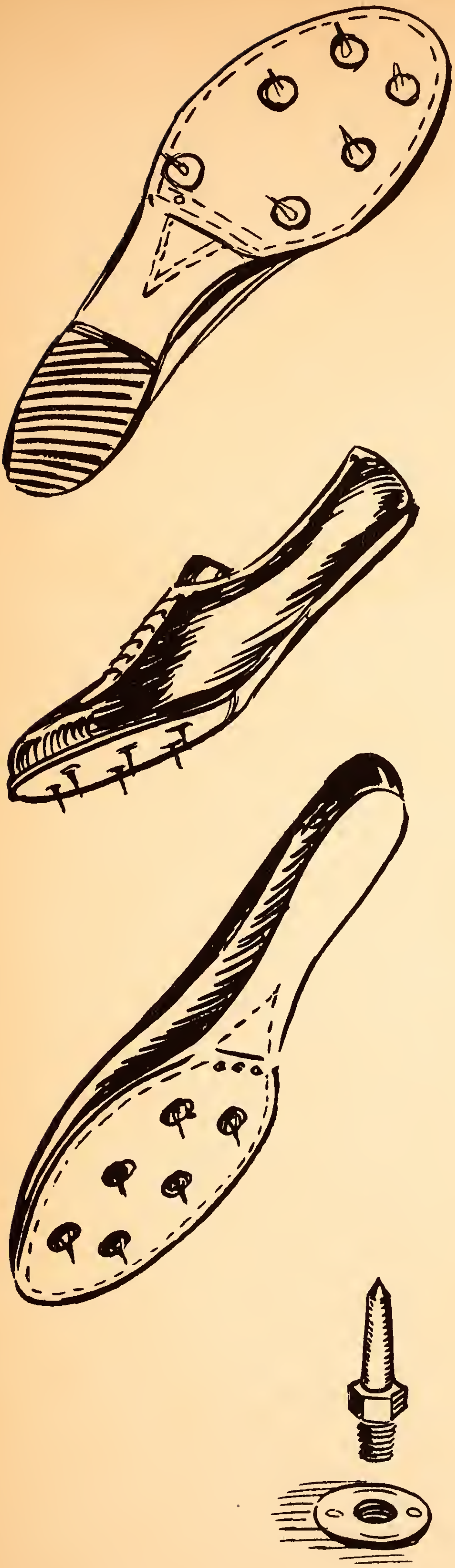
SHOES

The distance runner's shoes are the most important item of equipment, and cross-country men must possess a minimum of two pair. The most versatile cross-country shoe is the low-cost *rubber flat.* These shoes are used at all times in warm-up running and usually over concrete or frozen terrain where spiked shoes become difficult to compete in. They may be purchased at a reasonable price with a canvas or leather top, and where finances are limited, they can be used in all kinds of competition.



The *spiked cross-country* shoe with the small rubber heel is the second shoe that all distance men should own. This shoe provides greater traction over most surfaces, and when competition is on a major scale, it is the shoe to be worn.

The best quality leather cross-country shoe is made from yellow-backed kangaroo leather, but shoes of other leathers are also satisfactory. Most of the major athletic-shoe manufacturers now make a cross-country shoe with wider spike placement to minimize turned ankles and provide greater stability over rough ground. There are also several fine imported cross-country shoes on the market. Regardless of shoe make, the athlete should try the shoe on without socks, as all leather stretches. A glove fit is necessary for new shoes. The shoe tip should touch the large toe, but not cramp it, and the shoe should be wide enough to allow movement of all toes. A fine leather oil should be rubbed into all shoes to prevent drying and cracking after they become wet.



The most practical distance shoe has six *widely spaced* spikes in the front of the sole. The heel, as mentioned, is of rubber without spikes in most cases.

Some distance runners prefer a regular track shoe, with a small rubber pad placed *inside* the heel of the shoe. The objection to these shoes raised by most coaches is the relatively close (to the center of the sole) placement of the spikes.

When possible, the spikes should be changeable for use on varying terrain and surfaces. A short three-eighth spike can sometimes be used on mildly frozen or other hard surfaces. A five-eighth-inch spike is used mostly on soft grass or on wet courses. In general, the longer the spike the more danger there is of turning ankles when stepping on stones, etc., while running. Unless the ground is *very* soft, a shorter spike is usually safer.

LACES

A runner's shoe is no stronger than its laces. For this reason, new laces should be used for *all* important races. It is wise to completely unlace the shoes and then relace for each practice or meet. In this way the shoes can be drawn up tightly. A *double* knot should be tied, and a wise precaution is to wrap a strip of tape around the outside of the shoe and over the knot so it does not work loose during the run.

SUPPORTERS

The supporter should fit snugly, but not tightly. It should be washed every other day if possible. A web pouch seems to offer less irritation than other types for the track athlete. Good supporters come in small, medium and large sizes, while the very best may be purchased in exact waist sizes.

SOCKS

Foot care for the distance runner is of paramount importance, and the proper selection of socks is the first step in preventing blisters. The lightweight cotton sock is the most widely used, although the wool sweat sock may be desired for warmth during the cool fall weather. In any case, the socks should fit snugly so that no loose folds can cause irritation during a long race. The socks *must* be all white and contain no dye that might sweat out into open blisters. Many runners have found that painting the feet with benzoin, or rubbing clear wax on the inside of the sock for lubrication, prevents the formation of blisters during a long race.

JERSEY OR SHIRT

The majority of cross-country runners wear T-shirts during competition, and many wear a long-sleeved *lightweight* jersey during cold weather. In any case, the usual sleeveless track jersey is not often worn for cross-country running. The shirt, regardless of type, should be large enough to prevent binding under the arms, and is usually made of lightweight wool, cotton or rayon.

PANTS

During the warm fall days, regulation track pants of any lightweight material are practical. An elastic waistband is preferable to a drawstring for comfort and convenience. The pants must not fit too tightly at the waist or crotch, and a partial split up the side allows complete freedom of leg movement.

LEGGINGS

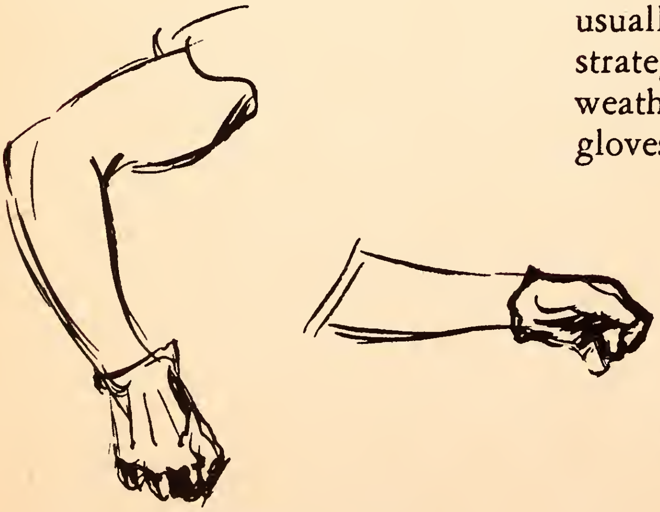
During the late fall, in many parts of the nation, cross-country runners find themselves running the bleak hills in extremely cold weather; in fact, the National Collegiate and A. A. U. meets are usually run over December snow. In these cases, many of the runners don leggings (reminiscent of red flannel underwear) that cover them from the hips to the ankles. The leggings are usually made of lightweight wool, but cotton or soft rayon is also good.

SWEAT OR WARM-UP SUIT

For warm-up activity prior to competitive or practice running, a heavy sweat suit is necessary. The ideal warm-up suit is made of wool, as it does the most thorough job of getting the athlete warm. The objection to the wool suit is often its cost, and for this reason the cotton fleece-lined suit is most widely used.

GLOVES

When running in cold weather most runners have learned that the hands are the first parts of the body that get cold. For this reason, practically every cross-country runner owns some lightweight gloves. The common cotton working gloves found in most ten-cent stores are usually satisfactory, and it is sound strategy to be prepared for cold-weather running by always having gloves in the equipment bag.



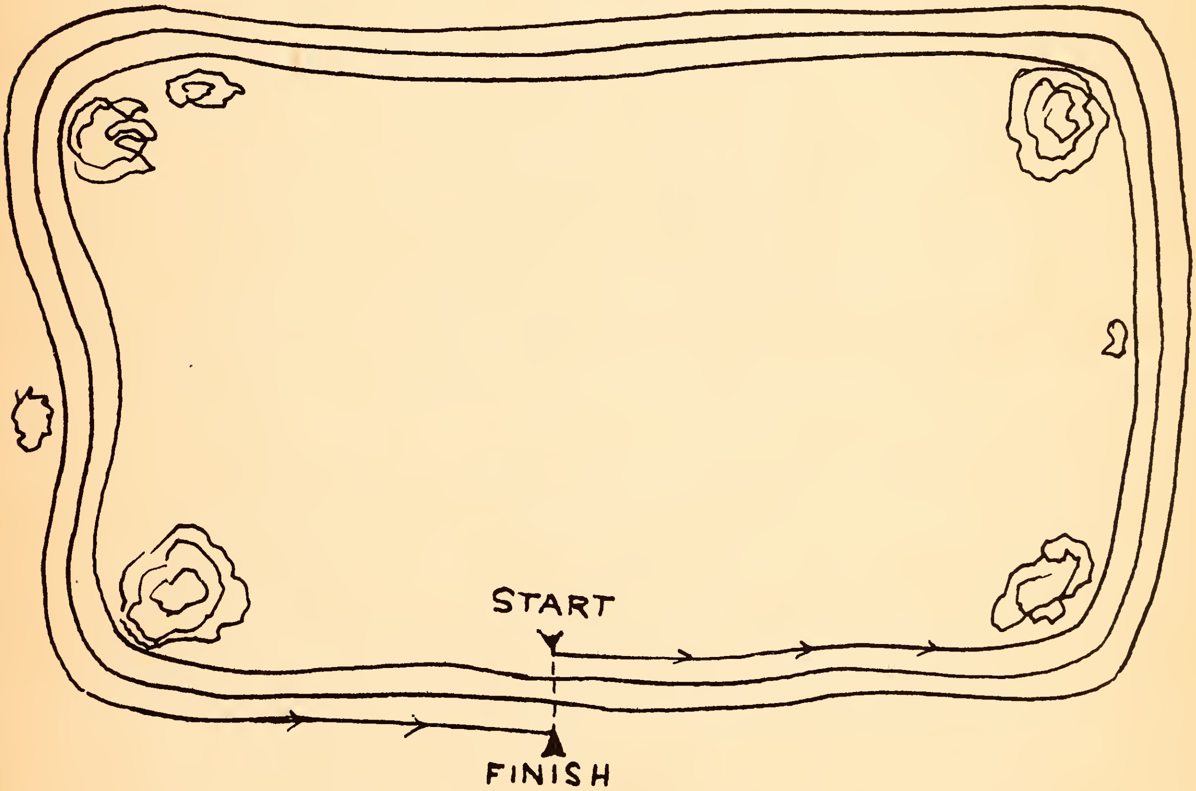
RUBBING GREASE OR OIL

The use of a lightweight grease rubbed over the whole body does much to keep men warm on cold days. Common petrolatum (vaseline) or olive oil with a *little* methyl salicylate mixed in is a satisfactory *warm rub* material for cold-weather running. Alcohol is *not* a good cold-weather rub.

THE CROSS-COUNTRY COURSE

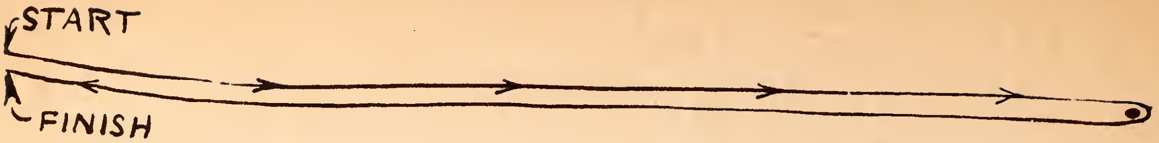
Most of the nation's better cross-country courses are laid out over rather hilly and rough terrain. They are simply more challenging and interesting for the athlete to run. It goes without saying that the ideal course is one where the athletes are not required to run over many concrete walks or roads. The ideal surface is usually soft in nature (grass). For this reason we find most of our major courses laid out in public parks or on golf courses.

It is, of course, impossible for every high school and college to have the necessary grounds for an ideal course. For this reason, cross-country today is run over many different surfaces, and the courses are laid out to fit a particular campus area. Here are the four most popular types of courses and the advantages of each.



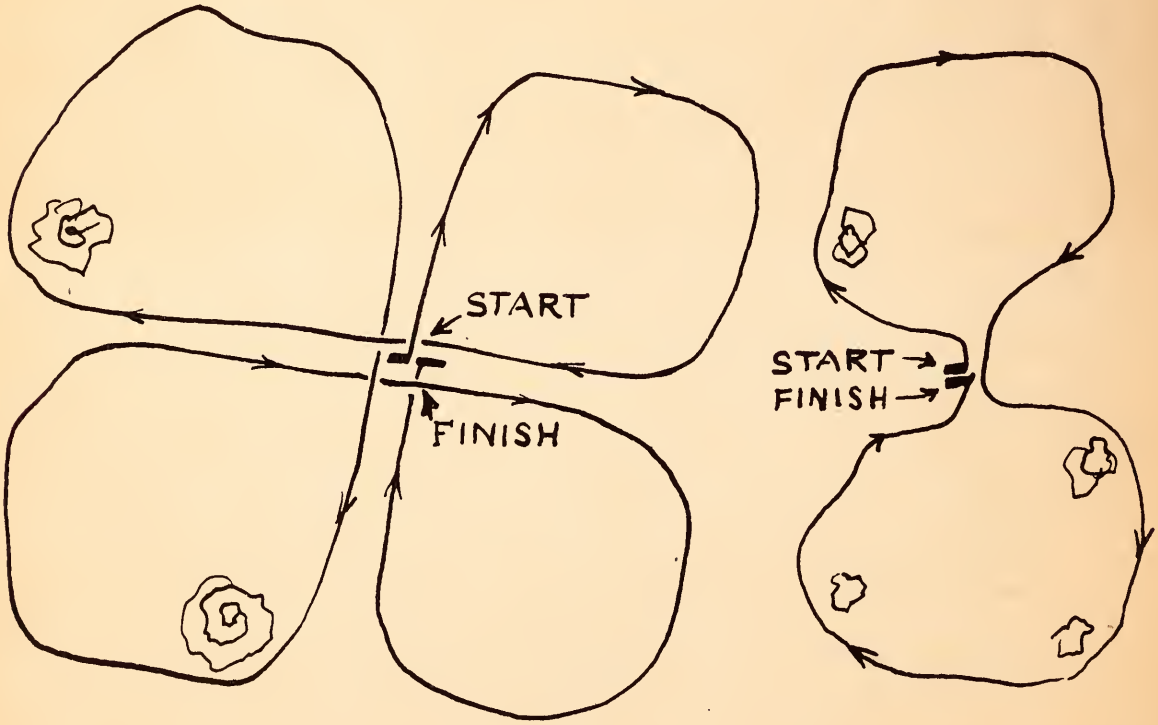
THE LAP COURSE

The lap course is the type most widely used. It is usually a large circular course that may be almost any length depending on requirements. When a course of this type is used, in four-mile races for instance, the runners pass the spectators and coaches at various stages of the race. A small lap course of a mile is also desirable for beginners to learn pace on. The coaches can easily call times to them on each lap. A course of this nature is *ideal* for the spectators and helps in creating spectator interest.



THE LOOP OR TRAIL COURSE

Where a natural trail or river bottom, or the like, is available, or where buildings and city conditions prevent a large or small lap course, a simple and often effective course is one where a post or natural marker is placed about a mile out on a two-mile course, or two miles out on a four-mile course. The runners simply run out to the markers, circle them and return to the start. This course is ideal for ease of marking and insuring a standard course where no cutting across or short cuts are possible. However, it is obviously very poor for the spectator, as the runners only appear at the start of the race and at the finish.

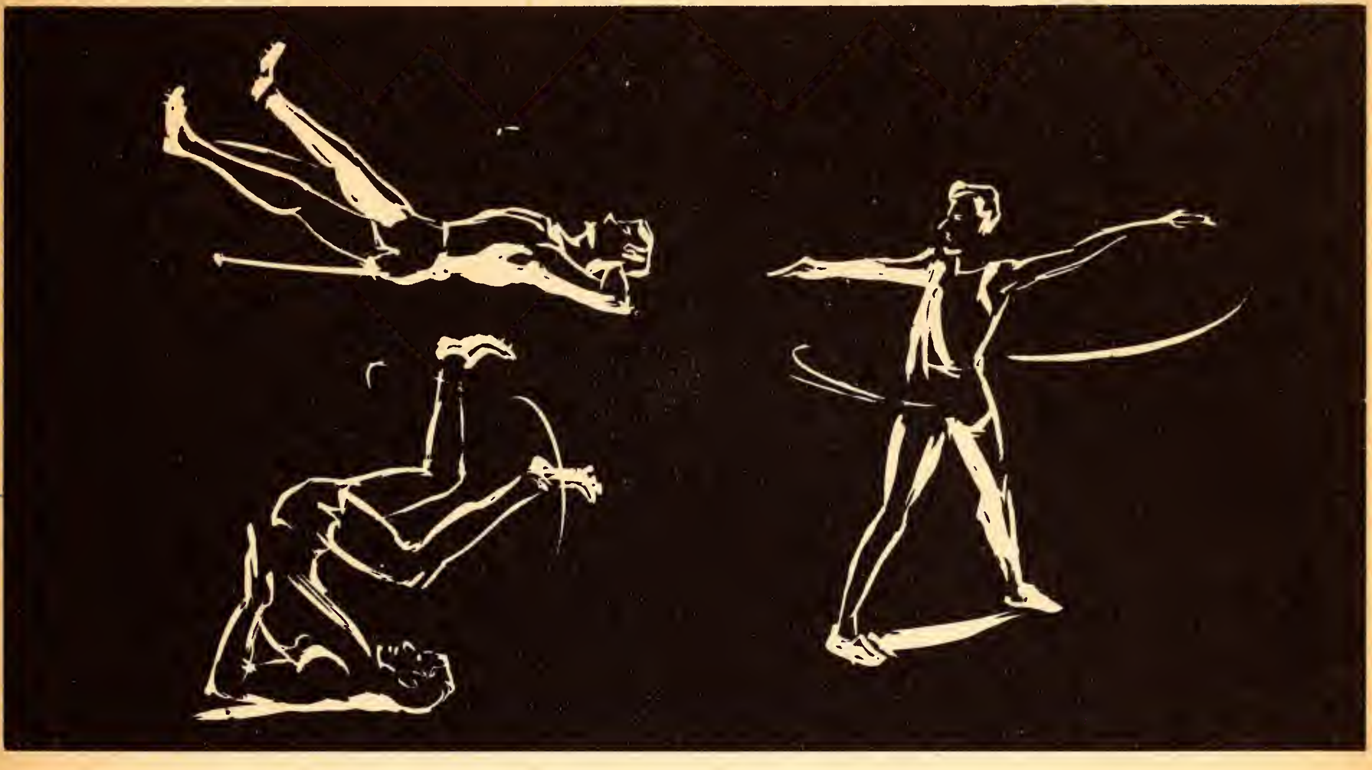


THE CLOVER LEAF AND FIGURE 8

Two very popular courses in use today are the clover leaf course and the figure 8 course. On a golf fairway, or in a larger area where space is abundant, these courses are ideal. They not only give the spectators and coaches a view of the runners periodically, but the course is interesting for the competitors as they do not usually have to run over the same area more than once.

Chapter II

DISTANCE RUNNING BEGINS WITH TRAINING



Distance running, above any other form of physical activity, quickly separates the trained from the untrained when competition starts. It is simply not possible to perform well in cross-country running unless every detail of training and conditioning has been attended to.

MODERATION IS THE KEY

The first thing that coaches and athletes must realize is that the key to sensible training is *moderation*. Practically anything done to excess can limit performance, including oversleeping, overeating, overworking and overdoing in almost any form of activity.

The athlete reporting for any sport must adjust his living habits if he wants to get the most from the physical qualities he possesses. He must realize that five factors will contribute materially to his physical efficiency as a runner. They are:

1. Proper diet and elimination.
2. Graduated physical work.
3. Necessary sleep and rest.
4. Abstention from all stimulants and drugs.
5. Mental conditioning for competition.

1. DIET

The proper approach to a training diet for cross-country is balance and, as mentioned, moderation. An athlete who eats at home, in the dormitory, or at a training table usually receives a substantial, well-balanced meal. He should avoid *exceptionally* greasy foods, and any others that disagree with him. During the competitive season the athlete must avoid experimenting with new foods, especially on days of competition and on trips where new and inviting dishes are listed on hotel or restaurant menus.

It is well to remember that the distance runner, as a rule, needs almost twice as many calories as the nonathlete. A total of 3,500 to 4,500 calorie units per day is usually required by the average runner.

The coach can check on diet through the use of the weight chart. In general, after the first few weeks of reasonably hard work, the athlete's weight should level off and stay fairly constant. Sudden drops in weight should be investigated by the coach and a medical adviser.

On meet days the athlete should eat sparingly. In no case should the runner eat later than four hours before competition. That meal should consist of bland, nourishing food in moderate portions.

All food should be well chewed to promote thorough digestion. Proper consumption of water is also necessary, particularly on days of competition, so that the athlete does not waterlog himself prior to the meet. Water should be sipped, not gulped, and should not be taken in large quantities. When sipped, the cold fluid is warmed before it reaches the digestive tract.

Many coaches feel that athletes should not eat eggs the day of competition, as they are composed of a sulphur base that sometimes causes gas to form, especially in a nervous stomach.

The use of salt tablets to compensate for body salt loss following strenuous work is physiologically sound. The time to take the additional salt into the system is during meals.

Regularity of eating hours is important. The body becomes accustomed to regularity, and efforts should be made to maintain uniformity. For this reason, eating between meals should be discouraged.

2. GRADUATED PHYSICAL WORK

To bring his body to a state of top condition and efficiency, the athlete must practice a carefully thought-out training program. This program must be gradual, developing each organ and system of the body proportionately, since all functions of the body are interrelated. Each individual must develop his own training schedule, as each has different problems and different needs.

In the following text a guide to this gradually increasing work is presented. It is not intended to be the *only* method of conditioning, but it is one way of training. Its general features have been proven over many years at the University of Michigan, and it is hoped that it will aid the coach and athlete in determining what type of work will be needed for the individuals involved.

3. SLEEP AND REST

Rest is essential in recuperating from strenuous effort. Sleep and rest are as basic to good training as any other factor; and most athletes need from eight to nine hours of sleep. Pressure of jobs and studies often cuts into the athlete's sleep at one time or another; in these instances he should attempt to find extra rest periods before practice or competition.

The average athlete usually has difficulty getting to sleep the night before competition; often a glass of warm milk or a very brief warm shower is helpful in promoting sleep. A cool room and a firm mattress are also conducive to sound sleep. The use of sleeping pills or powders should not even be considered.

Getting to bed by 10:00 P.M. is one of the first habits that a serious distance runner should form. The only way to conserve and build up physical and nervous energy for a race is through proper rest. There is just no substitute for it.

4. DRUGS AND STIMULANTS

Tobacco and alcohol are two of the most common forms of dissipation. The distance runner cannot justify the use of either; a cigarette or a drink of alcohol has never improved the condition of any athlete. Conversely, several studies have shown that the use of tobacco or alcohol hinders top physical performance. The detrimental effect upon the athlete may be mental or physical, or both.

The immediate value of sugar or dextrose wafers in a distance race under six miles is a matter of individual opinion. A more detailed discussion of the subject is in the following chapter. Many athletes, however, claim they feel extra energy after using dextrose or sugar (in short races), but whether the boost is physiological or psychological is hard to determine. In any event, no harm can come from taking a dextrose wafer or two, and we do know that it helps reduce the appetite.

5. MENTAL CONDITIONING

The mental approach to all phases of distance running is vital, and like the body, the mind can often be trained to overcome many difficult obstacles.

The mental requirements for cross-country running are closely tied to performance in several ways. The most obvious are:

1. Sheer courage.
2. Ambition and pride in performance.
3. Pace judgment.
4. Confidence.

Analyzing and thinking can often improve all of the above areas, yet no phase can show *real* improvement unless the mental conquering of fatigue takes place.

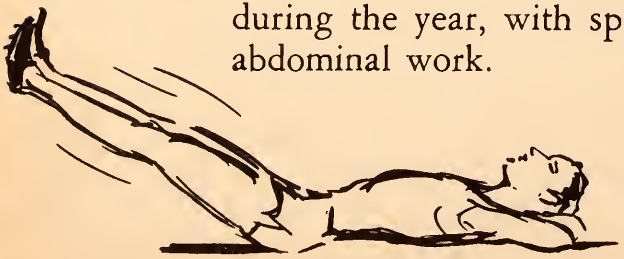
Without exception, mental fatigue sets in before physical fatigue. Even the greatest of athletes thinks he is tired before his body is really physically tired. Training and conditioning programs should recognize this problem; often the athlete can overcome this "feeling of being tired" and perform much closer to *real* capacity. Courage, pace knowledge and well-directed training build confidence; and confidence is a great factor in a man's struggle against feeling fatigued before his body actually becomes tired.

Another factor to deal with in the struggle against mental fatigue is the warm-up. Failure to warm up properly usually leads to an early sensation of fatigue, because the body has not been prepared physiologically for the work it is to do. The sensation of second wind is usually experienced by undertrained runners, or in men who have failed to warm up properly. The reason for this is that second wind is a physiological adjustment that the body makes to meet the demands being placed upon it. The well-conditioned athlete has much less sensation of second wind than does the poorly trained athlete, since the well-conditioned man has to make less bodily adjustment.

OTHER TRAINING AIDS

The entire training picture embraces many more aspects than those mentioned, and the coach and athlete should consider the following recommendations. It is the attention given to details such as these that often provides the extra point or points during competition.

1. Health examinations are a must, and chest X ray should be required of all cross-country runners.
2. Clean locker rooms and shower areas are important. Shower clogs are valuable to prevent "athlete's foot" and other infections that may keep a man from his best performance.
3. Clean clothing, especially the supporter and socks, help prevent rashes and inflammations that could remove a boy from training or competition.
4. Elimination of all horseplay in and around the locker rooms prevents many avoidable injuries from occurring.
5. Immediate treatment for all injuries, no matter how slight, should be given.
6. A continual program of calisthenics should be conducted during the year, with special emphasis on upper body and abdominal work.

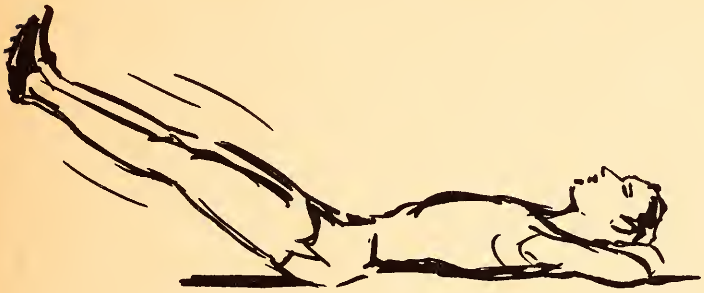


THE EXERCISE PROGRAM

There are many exercises the distance runner can use to advantage. However, he should keep in mind that it is very difficult for upper body development to proceed as rapidly as lower extremity development. For this reason the major emphasis should be placed on exercises that tend to do something for him above the hips.

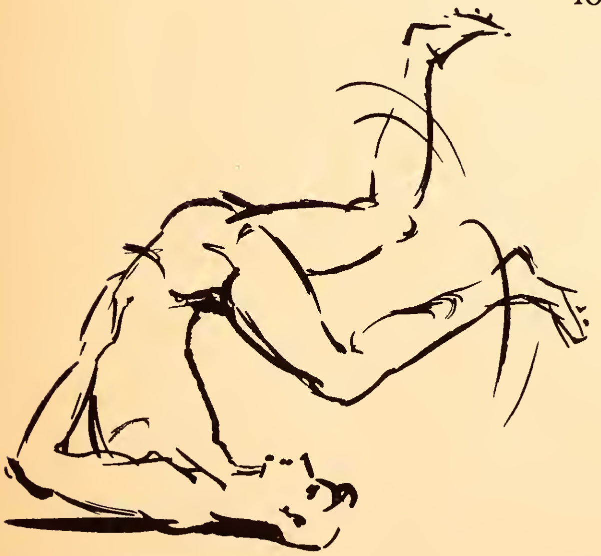
Most coaches allow only stretching and light bounding exercises for the distance runner's legs, since they feel that running itself leads to the most advantageous lower extremity development. It seems that heavy squatting exercises are *not* beneficial for the runner, as they tend to develop a heavy, slow muscle.

Following are the types of exercises that the distance runner can use to advantage in his warm-up and exercise program.



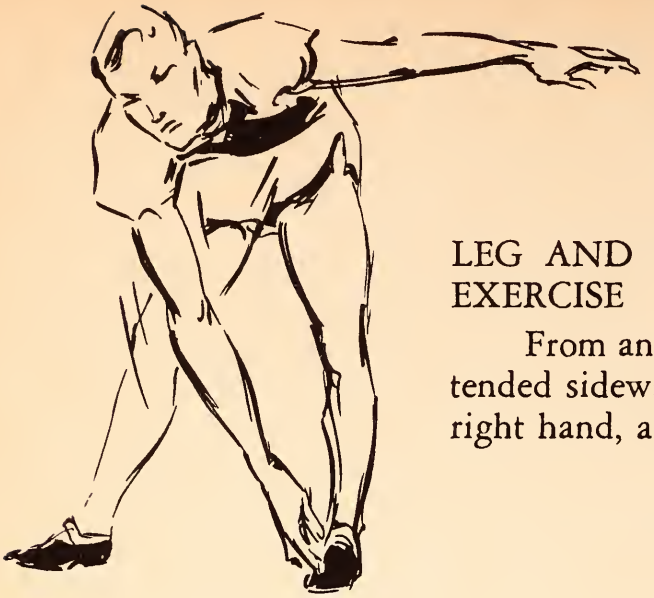
ABDOMINAL EXERCISE

From supine position, raise legs off ground with knees straight, then lower. Repeat many times.



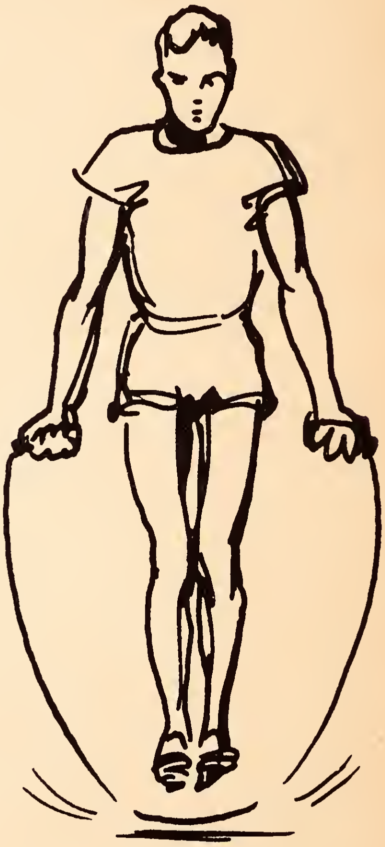
HIP FLEXIBILITY EXERCISE

From supine position, raise the body as in the illustration, and rotate the legs as in riding a bicycle. Start slowly and increase speed.



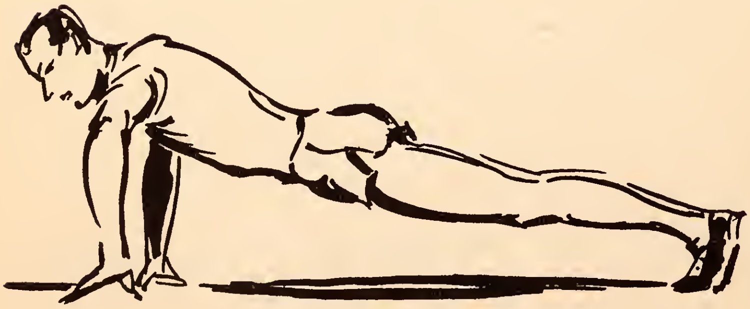
LEG AND BACK STRETCHING EXERCISE

From an erect position, arms extended sideward, touch left toe with right hand, and repeat to other side.



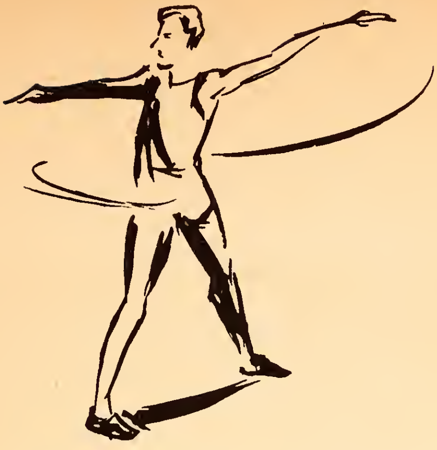
FOOT AND ANKLE EXERCISE

Skip rope a little each night from the first day of practice until the final meet. This is the best exercise to minimize turned ankles and to strengthen arches that are placed under great strain by all cross-country runners.



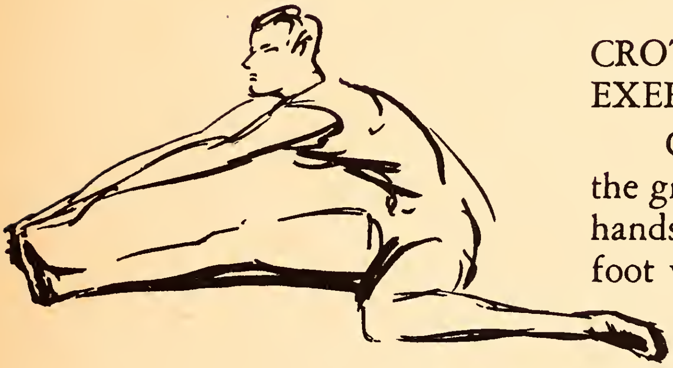
ARM AND SHOULDER GIRDLE EXERCISE

With body in position as shown in illustration, touch chest to the ground, and then push up to arms-extended position.



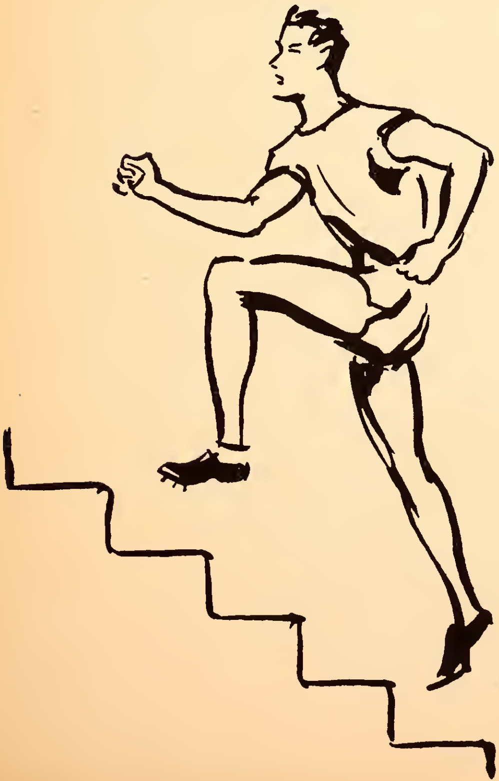
TRUNK STRETCHING EXERCISE

Rotate the trunk, with arms extended, as far to the right as possible, and repeat to the left.



CROTCH FLEXIBILITY EXERCISE

Go into a hurdler's position on the ground. Reach forward with both hands in an effort to touch the lead foot with the hands.



KNEE AND ANKLE EXERCISE

Run up the aisles of the stadium using a high leg lift. Walk down and repeat several times. Always attempt to bound up steps on the toes.

Chapter III

MENTAL AND PHYSIOLOGICAL APPROACH TO DISTANCE RUNNING

Any boy who has done even a minimum amount of running soon realizes that his performances improve as a result of work. Many a youngster, however, does not realize why he improves, and an understanding of the changes that take place in his mind and body is a vital step in advancing toward even better performance.

Briefly stated, the training that a cross-country runner does makes three significant contributions to his constant improvement. They are:

(1) Refinement of the mechanical aspects of running, commonly referred to as "form" or "style."

(2) Improvement in the mental approach to the distance to be covered, since by constant running he begins to "feel" the race.

(3) Increased efficiency of metabolic processes, such as the respiratory system (breathing) and the circulatory system (heart).

CONSERVING ENERGY

The athlete who masters a comfortable and efficient style of covering ground will find himself getting less tired during a race, because he is devoting a minimum amount of running energy to overcoming his own mechanical faults. Style alone, however, has never made a distance runner, but an uncomfortable, tense and inefficient method of covering ground has handicapped many.

As mentioned, the most important factor to becoming a successful distance runner is in overcoming the "feeling of being tired." If there is a secret to running long races well, it is the ability to distribute available energy evenly over the distance to be run while breaking through the individual ceiling on "feeling tired." Few runners ever perform up to complete physical capacity during a long race.

Some fail because they do not understand or realize their physiological horizons, and others fail due to improper training or lack of courage. Most men feel tired (and perform accordingly) long before (physiologists tell us) they are *actually* physically fatigued. It is the understanding of fatigue, both mental and physical, that often aids in distinguishing between really being tired and thinking one is tired.

MIND OVER MATTER

The importance of the "mind over matter" principle is so great that most fine distance-running coaches today feel that the next great contribution in distance-running performance will not be made by coaches or trainers but by physiologists and psychologists as they show us a practical method for men to overcome mental barriers that we know limit performance. Many laboratory experiments with isolated muscle groups have indicated that what we today regard as physical fatigue in the well-trained athlete may by tomorrow be regarded as merely preliminary tiredness.

The 1952 Olympic Games at Helsinki, Finland, produced many examples of men of all nations breaking through their personal "fatigue ceilings." In fact, prior to the games, the experts would have ridiculed the prediction that any one man would win *all three* of the long races (5,000, 10,000 meters and the marathon), yet Emil Zatopek, of Czechoslovakia, did it with ridiculous ease in record time. It was almost as unbelievable for Horace Ashenfelter, of the United States, to run the 3,000-meter steeplechase in the world record time of 8:45.4, and for Bob McMillen, an American, to run with the world's best in the 1,500-meter race in the remarkable time of 3:45.2, five seconds better than his previous best.

These and other fantastic performances at Helsinki can mainly be considered as examples of men breaking through *mental* barriers that had previously limited their performances, as physical condition could not have improved so drastically in the few weeks preceding the games. Many factors always contribute to better mental approaches, and four factors seem to stand out in why *Americans* at least were so remarkable at Helsinki.

(1) The meeting with Russia for the first time.
(2) Invigorating cool climatic conditions gave a freshness of mind not present in our own championships held in the heat of June in California.
(3) The inspiration of seeing and competing against some of history's best athletes, such as Zatopek, Barthel and Kazantsev.
(4) A remarkable team spirit instilled by the United States coaching staff.

The "unbelievable" performances of Ashenfelter and McMillen alone should illustrate to the high school and college youngsters that the difference between greatness and near greatness is often merely the state of mind.

PHYSICAL ASPECTS

The limitations placed on performance by *physical fatigue* have long been recognized, and coaching technique has done a great deal toward raising these particular limitations. Dr. Sid Robinson of Indiana University, a former Olympic distance runner under the late E. C. "Billy" Hayes, has done more to lift the curtain on the problems of fatigue in distance runners than any other American. His hundreds of fatigue tests at both Harvard and Indiana form the basis upon which most American coaches conduct their distance training. The thoughts expressed here are the result of conversations and correspondence with Dr. Robinson and a detailed study of his revealing research.

From a physiological standpoint, Dr. Robinson has shown through experiments that a runner's ability to sustain himself in a long race is limited by the following factors:

(1) The oxygen supply to the muscles during a run.
(2) The oxygen debt incurred by performance.
(3) Fuel available for supplying energy to the tissues.
(4) Body temperature.

The distance runner's energy is derived mainly from the oxidation (or burning) of muscle glycogen (carbohydrates) during the race. Runners should realize that the normal trained athlete has enough glycogen stored in his muscles to complete a cross-country race of more than six miles, and the factor that tends to limit his performance is the supply of oxygen for turning this glycogen into energy.

The heart, pumping blood (containing oxygen) through the circulatory system, provides the muscle tissues with the needed oxygen. When the runner is not properly trained, or when the race pace becomes very fast, the heart simply has difficulty pumping enough blood through the body. The muscles are thus forced to work without adequate oxygen supply. The muscles then begin to take more of their energy from a direct breakdown of the glycogen into lactic acid. However, an accumulation of lactic acid in the muscle tissue decreases the ability of the muscles to contract, and a loss of co-ordination is the result. The sensation of "boarding up" or "tieing up" is caused by large quantities of lactic acid present in the muscles. The athlete has thus gone into "debt" for oxygen by transforming the glycogen into usable energy. This "oxygen debt" is quickly repaid following the end of the strenuous work.

PERFORMING TO CAPACITY

Each individual seems to have a personal limit with regard to "oxygen debt," but few men ever reach it. Runners may reach the limit in a short race at a rapid pace, or in a long race at a slower pace. We do know that *sheer determination* can bring a man closer to his absolute oxygen debt.

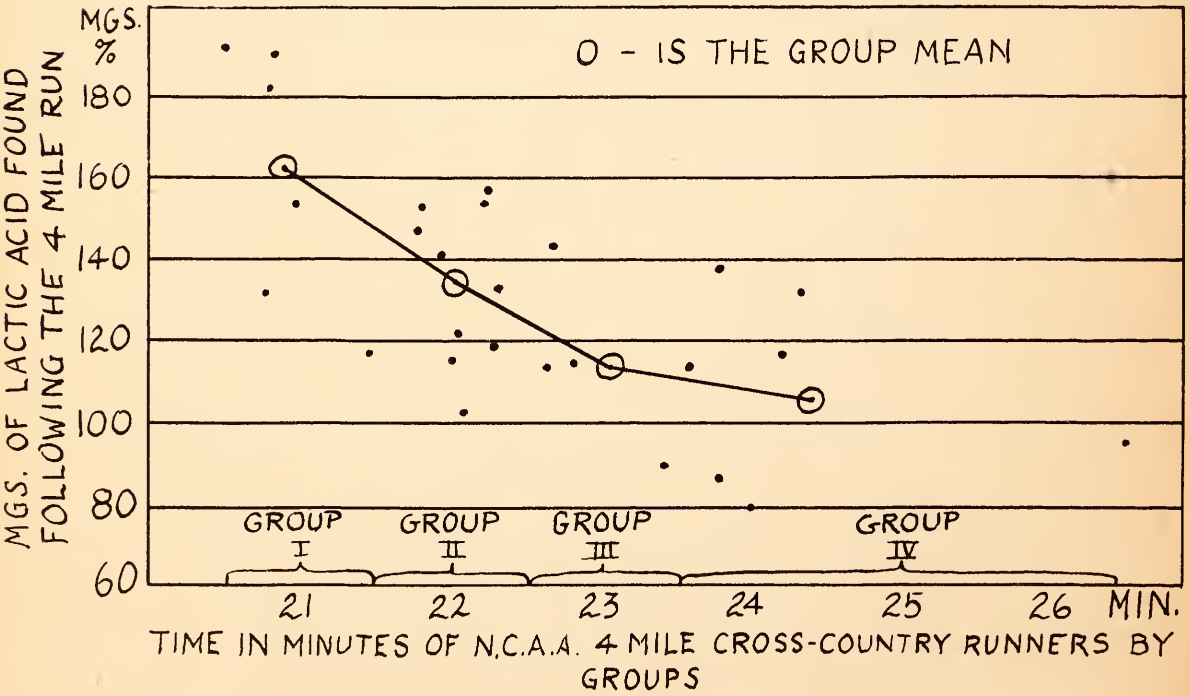
In addition, proper training increases the oxygen supply to the muscles by improving respiratory and circulatory systems, allowing the athlete to do greater work (to run faster and farther) before he reaches the limits of his oxygen debt. A combination of determination and training then leads to better performance.

One of the most interesting studies made by Dr. Robinson was made at the 1941 N.C.A.A. four-mile cross-country championships. By taking blood samples of the runners at the finish of the race he revealed:

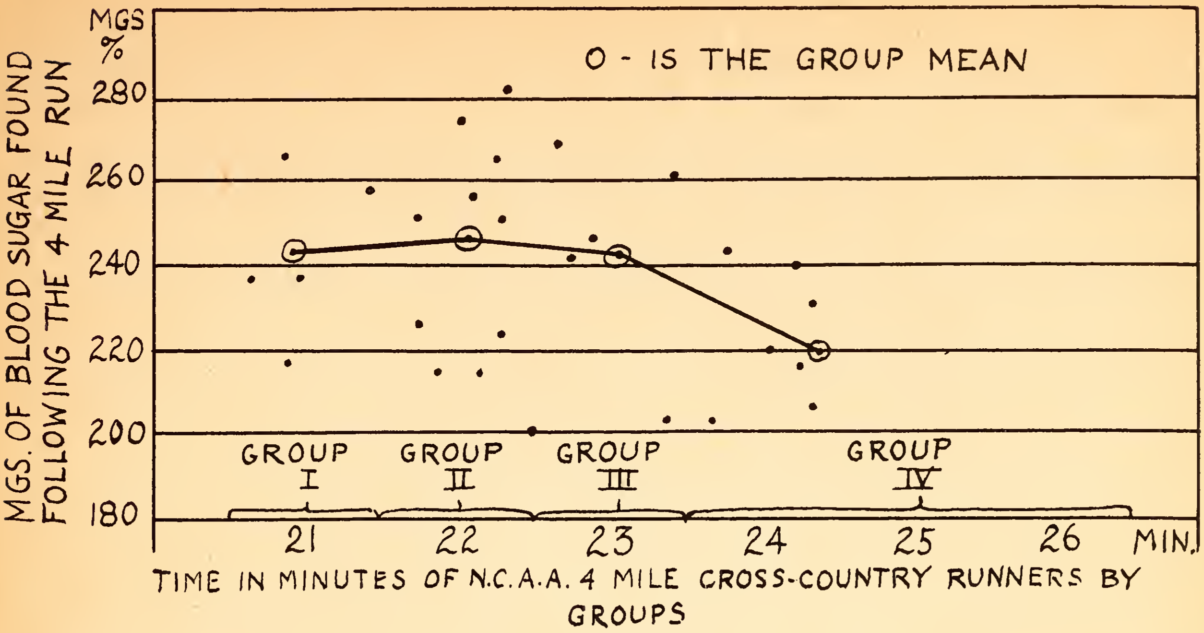
(1) There were *no* low blood sugars found in any of the finishers, indicating to distance runners and coaches that there is no danger of exhausting the carbohydrate reserve in well-trained athletes in even the hardest of four-mile races.

(2) The men who were the highest finishers had the *greatest oxygen debts,* and the greatest quantity of lactic acid present. This indicated to coaches and athletes that, regardless of talent, the winners *extended* themselves more than the losers.

(3) The ability to utilize the oxygen debt and to pile up greater amounts of lactic acid was greatest in men who were in the best physical condition.



The above table, compiled by Dr. Sid Robinson from tests made at the 1941 N.C.A.A. four-mile cross-country run, should prove to coaches and athletes that in general the leaders extended themselves more than the trailing runners, as they showed more lactic acid in their blood following the race. It is interesting to note, however, that *not even the winners* reached the limit (so far recorded) of 200 mgs., a fact that might indicate that even greater effort could have been put forth.



Dr. Robinson's Table shows little correlation between blood sugar (fuel) and performance, except that men finishing far behind in the race (on an average) show lower blood sugar than the leaders. The graph should indicate, however, that because there were no low blood sugars recorded after the race, it is probably safe to conclude that even a four-mile race is not long enough to exhaust the carbohydrate reserve (fuel) in a trained athlete. Still, cross-country runners are well advised to eat extra carbohydrates during the forty-eight hours before they race. Those who enter very long races may be helped by eating dextrose during a race to supplement glycogen reserves and prevent the body from using fat—a less efficient muscle fuel—for energy.

Distance and cross-country runners should also understand why their best races are often run on cool or even rainy days. One of the best explanations for this phenomenon is concerned with the fact that when runners burn glycogen or other fuel to provide energy they also generate heat that raises the body temperature. Research shows that lactic-acid production is increased with an increase in body temperature. Inasmuch as muscle efficiency decreases with increased lactic acid it should be quite clear to the coach and athlete that a lower body temperature can lead to better performance. Heat generated by the body must be passed off through the skin and lungs. In cool weather the athletes are not greatly hampered by the burden of eliminating heat during a race, the body temperature remains lower (than in hot weather) and the production of lactic acid is less. Thus the possibility of better performance is usually better on cool days.

The problem of energy and fatigue in distance running has many aspects, but an understanding of the basic principles mentioned should aid the distance and cross-country runner to analyze the total problem and then to do something about it.

SUMMARY

The following points should be understood by any who aspire to success in distance and cross-country running:

1. Mental conditioning is one of the keys to success in distance running. A "feeling of being tired" is not necessarily physical fatigue. A tenacious will to remain on a good pace is the mark of the champion.
2. Preventing early oxygen debt by an evenly paced race is essential to success. It keeps the lactic acid at its lowest level until late in the race.
3. Intelligent, conscientious and well-directed physical work over a long period enables a distance runner to increase the efficiency of his circulatory system and thus get greater amounts of oxygen to the working muscles.
4. Trained athletes can perform closer to capacity than untrained ones, as research indicates that they can perform under greater oxygen debt and with more lactic acid present.
5. The average cross-country runners do not exhaust their blood-sugar supply (glycogen) during a race up to six miles, but keep it at a high level by wisely consuming additional carbohydrates during the 48 hours before competition.
6. Cool weather enables the body temperature to remain lower during distance races, and as a result less lactic acid is produced in cool weather than in hot weather with the same work. It is reasonable to assume that a faster pace can thus be carried in cool weather.
7. Men running more than ten miles may be able to increase their efficiency by eating dextrose during the race, since it has been shown that marathon runners *may* deplete their glycogen reserves.

Chapter IV

BEGINNING CROSS-COUNTRY TECHNIQUES

Without exception all of the world's greatest distance runners began their careers on the cross-country course, and each year additional thousands of runners "take to the hills" in this great fall sport. A look at the roster of some of our national distance-running champions on the track, such as Don Lash, Gil Dodds, Fred Wilt, Don McEwen, Bob McMillen, Horace Ashenfelter, Wes Santee and many others, should indicate the part that cross-country running played in their careers. Each was a champion over the "hills and dales" before he was a star on the cinder paths.

COURSE MARKING

The fall sport of cross-country running (in America at least) is usually over a course one to three miles in length for high-school boys, and from three to six miles for college youngsters. The course should be accurately measured, and posts at half-mile intervals should be set along the way for timing the runners. There are several methods of marking the course for the runner.

(1) The most clearly marked course is one where a lime line is laid on the ground along the entire distance to be run. Over a snow-covered course coal dust is usually used as the marking substance.

(2) The use of colored flags as guide posts is the second most practical method of course marking.
  (a) A red flag indicates a turn to the left.
  (b) A white flag indicates a turn to the right.
  (c) A blue flag indicates the course is straight ahead.

(3) Sign posts can be used with directional arrows, so placed that approaching runners can clearly determine the path and direction to follow.

The ideal method of course marking for an important meet is by use of flags, sign posts and the white lime line. This use of all three marking systems practically eliminates the possibility of the tired runners getting lost on a strange course.

CROSS-COUNTRY SCORING

Each team competing in a cross-country meet usually consists of seven men (unless otherwise agreed). The first runner to finish scores one point, second place: two points, third place: three points, and so on. All of the competing runners who finish are ranked and scored in this manner. The final team score is then determined by totaling the points scored by the *first five* finishers of each team, and the team with the *lowest* total, of course, is declared the winning team.

Even though the sixth and seventh runners on a team are not able to post scores for their own squad, these "kickers" can *increase* the total team scores of the opposing teams if they finish ahead of any of the first five runners on an opposing team.

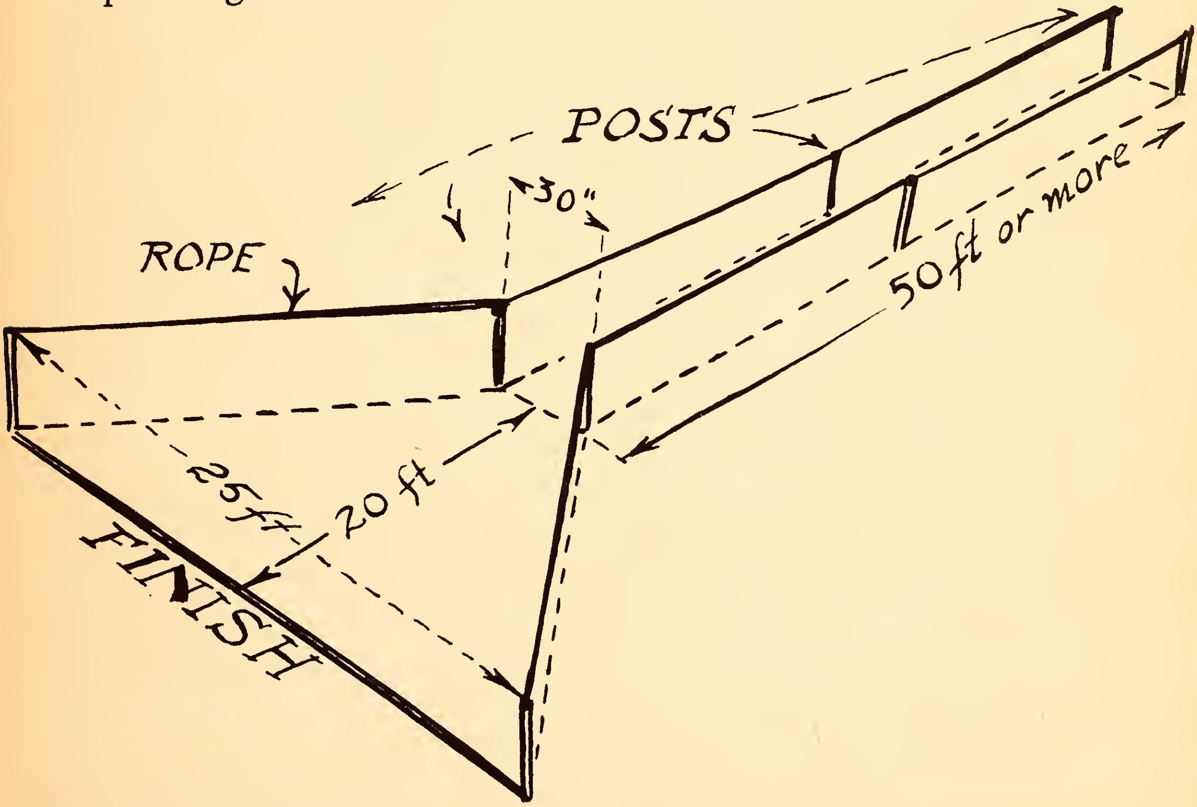
In the event a team does not finish at least five men (or the scoring number agreed upon) the *places* gained by the few who do finish shall not be counted. For instance, assume that a man wins the race but is the only one on his team to finish. The second-place runner would then be awarded the first-place points, and all other runners would be moved up accordingly when scoring. If the point totals of two or more teams (five scorers) are equal, the event shall be called a tie.

OFFICIATING

Officiating a cross-country meet can be rather difficult when, during a championship race, as many as three hundred runners cross the finish line. For dual or like competition the task of judging the finish is not so complex. In any case, the N.C.A.A. recommends that the minimum roster of officials for a cross-country race consist of the following groups and officials:

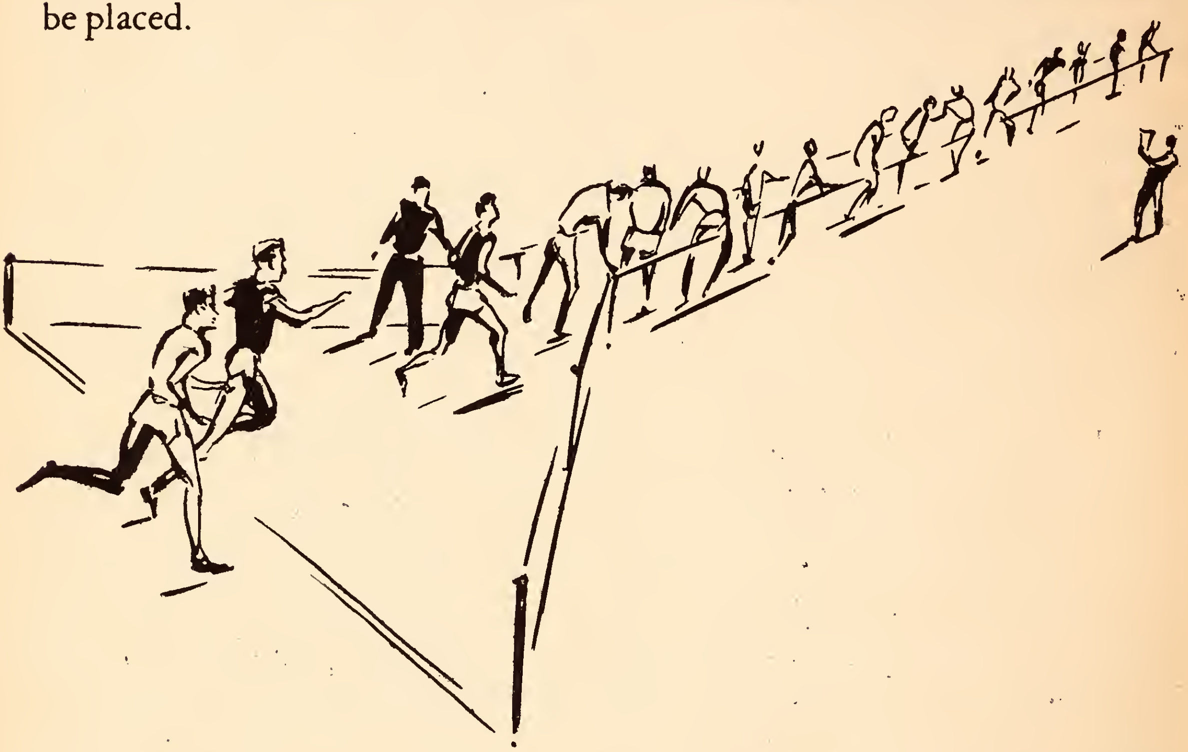
1. The games committee
2. A referee
3. Four finish judges and recorders to assist them
4. A starter
5. A clerk of course (more than one in a large meet)
6. As many inspectors as necessary
7. A minimum of three timers

Finding competent and experienced cross-country officials is often a real problem, and the key man is the clerk of course, as he is responsible for supervising the entire race.



THE FINISH CHUTE

In small meets, as mentioned, it is not difficult to judge the finish. As the athletes cross the finish line, the judges record, by number, the order of finish. However, when there is a large number of runners, the most efficient method of recording the finish is by way of a finish chute. The chute, constructed out of posts and ropes in the shape of a funnel (see diagram), extends about seventy feet beyond the finish line, or as far as necessary to accommodate the number of runners. In recording the order of finish, the judges stand on opposite sides of the finish line and call off the finishers as they see them. Assistants record the numbers as they are called off. When the number of runners is very large, four and sometimes eight judges are needed to guide the tired competitors into the chute in the proper order. As each of the N.C.A.A. runners reaches the end of the chute, he is given a *position card* indicating the order of his finish. This card serves as a receipt for the runner and the coach. The name or number of the finisher is also recorded, by a clerk, on a duplicate position card, and this card becomes the official finish card. Whenever there is a dispute, a check can be made by comparing the judges' recordings at the finish line with the official position cards, and in this way a missed man can usually be placed.



Several official position cards at a time are taken to the scoring table. In this way both the team scores and the order of finish are available to coaches, spectators and the press almost as soon as the race is over. A further refinement in scoring used at the N.C.A.A. cross-country meet is a large board behind the scorer's table where the names of the athletes are recorded for all to see, and where the team score can be rapidly computed. This system requires, however, that the meet management prepare a large name card for each runner in the race. These cards are arranged on the scorer's table so they may be quickly located and placed on the board when the official finish cards start coming in at his table.

In large meets movies of the finish are of great importance, as human errors in picking are always possible when men are crossing the finish line in groups. A review of finish pictures has insured an accurate placement on more than one occasion.

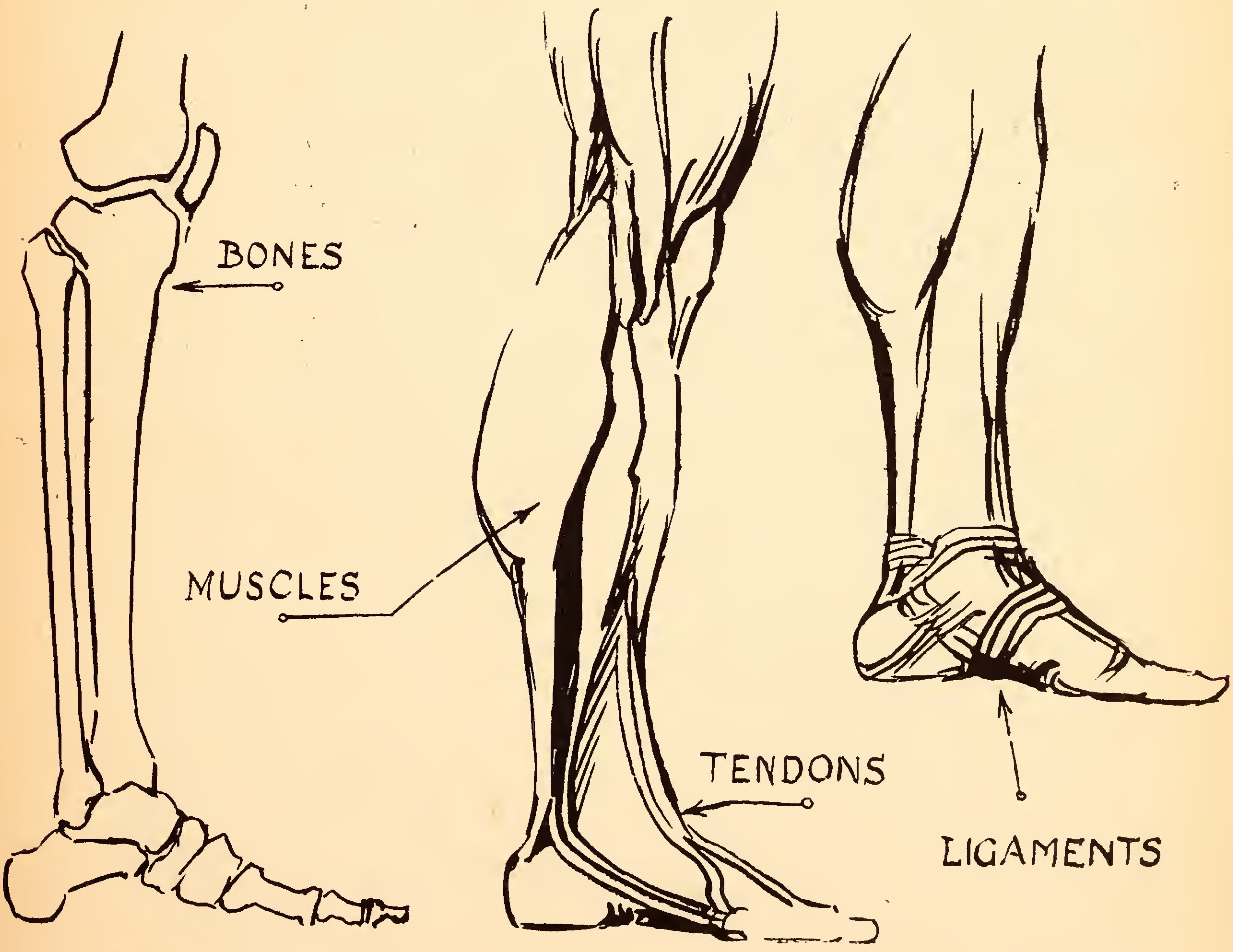
It is, of course, imperative to have the cross-country runner's number pinned on his chest. In big meets numbers pinned on both the chest and back aid the finish judges immeasurably.

At Michigan we have for years used a timing system that enables us to get a time for *every man* in the race. We use two and sometimes three timers *in addition* to the official timers who clock the winner. Each of these extra timers has two assistants. One assistant will call off the numbers of the men as they cross the finish line. The other assistant continually reads his watch aloud. The head timer then records as many numbers as he hears called off and, at the same time, records as many times as possible. It is impossible for each timer to record a time for each of the finishers, but when the three timers compare their final sheets almost everyone has been timed. It is a simple matter to fill in times of men missed by consulting the finish charts.

MECHANICS OF RUNNING

Youngsters beginning a distance-running career, and veterans alike, should first understand the mechanics of running, for only through understanding can one appreciate the "whys" of cross-country training.

There are four principal structures involved in running. They are:



All of the above structures are interrelated, and develop not only with maturity but with work or running.

Physiologists agree that a runner usually does a great deal more body building than he realizes. Respiratory and circulatory systems are improved, but physical improvement does not stop there. Running strengthens the muscles, and in order for the bones to support the stronger muscle structure, nature provides that the bones, too, become stronger. The ligaments are the connectors between parts of the joints; they are not only strong but elastic, making joint movement possible. With work (running) the ligaments, too, become stronger. The tendons are the fibers that hold the muscles to the bones, and they also are strengthened by running and the resulting muscle development.

Cross-country running over hills, as well as over soft and hard surfaces, uses more muscle groups than any other form of running. For this reason hill-and-dale running has long been regarded as the best exercise for strengthening the track athlete's muscles, bones, tendons and ligaments.

REQUIREMENTS

There is no special body type required for successful cross-country running. The athlete may be tall and thin like Bob Black of Rhode Island, of medium build like Don Lash, or short and stocky like Greg Rice. The only consistent feature found in great cross-country runners is a tenacious will to perform up to capacity. Boys with little natural talent can develop from week to week and from month to month on the hills and dales at a far more rapid rate than they usually can while training for a race on the track. This is true because the race is usually long and most often run over rough surfaces, a fact which places the major requirement for success on strength rather than on leg speed. Any youngster who has ever run soon learns that strength is much easier to develop than leg speed, and in cross-country sheer hard work pays *great dividends* in acquiring endurance.

COACHING SUGGESTIONS

The major coaching problem presented to the average high-school coach, and in many cases to the college coach, is dealing with youngsters who know very little about the sport of cross-country or distance running.

Getting boys interested in "wanting" to run is usually the first step toward successful cross-country teams. The initial move should be publicity on cross-country. Movies shown in the high-school assembly, bulletin boards in the school halls, newspaper publicity and any other method of bringing the sport before the eyes of the student body is of great importance.

Once the boys report, the personality, enthusiasm and imagination of the coach spell the difference between good and poor squad morale, and as in all team sports, high morale of the group is essential to success.

With beginners there are several points the coach must not overlook. He should:

1. Start slowly and build confidence by always working the boys at distances they can negotiate successfully. Discouragement most often occurs during the first few days when legs are sore and wind is short.
2. Work with groups so that the poorer boys are not faced with humiliation by running far behind the better runners.
3. Be free with encouragement to even the poorest of runners.
4. Constantly emphasize improvement rather than fast running time. Examples can be cited of now-successful runners who were not outstanding during early training. An improvement chart or table should be used in the locker room.
5. Provide competition of some kind for even the youngest and poorest of runners. Holding interest and incentive is most easily accomplished by providing a chance to represent the school.
6. Constantly remember and emphasize to the runners that a season of experience and another year of age often leads to remarkable improvement.
7. Select interesting courses (more than one is desirable) to stimulate the runners and prevent boredom during a long practice or meet run.
8. Create a sense of team pride in the squad from the start, and show by illustrations how important the last man on the squad is toward winning meets.

Rollie Langerman, the track coach at Walled Lake High School, Michigan, has had outstanding success in the promotion of cross-country, and one of his innovations that has seemed to pay great dividends is the inclusion of the cross-country team at the football pep rallies. He merely gets up at the meeting, says a few words and then introduces his squad. It is great public relations and gives his distance runners the recognition that is so vital to any endeavor.

For several years at Michigan we have created interest, provided competition and satisfied the desire for recognition for a large number of cross-country runners by what we call "Shirt Races." Following three weeks of preliminary work we run our first shirt race and give blue T-shirts to the first fifteen men to finish. Then throughout the fall, whenever we run time trials at any distance, we consider them shirt races. As long as a man stays in the first fifteen finishers, he hold his shirt. If he falls below the first fifteen, he loses his shirt to the white shirt that beats him out. At the end of the season the men who held their shirts the most times are awarded prizes. In the past we have given tie clips, belt buckles and medals, and we have always felt that the small amount of money involved for the awards was well returned in spirit, effort and general enjoyment on the part of the boys. The major value of a program like this is that even the poorest runner has incentive as he attempts to break into the "blue shirt" monopoly. It is a system that might be considered by high schools and colleges alike when they set out to plan their fall running programs.

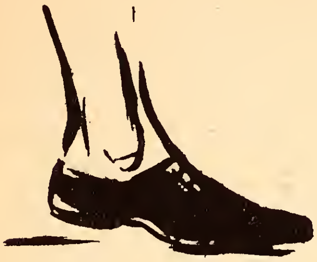
FORM TECHNIQUES

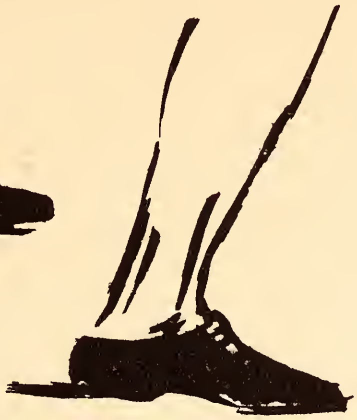
After the coach has carefully planned his fall program, the teaching of basic running form to the beginner is one of the initial steps when practice gets under way.

It is quite possible to overcoach in many phases of track. Distance-running form is a case in point. Style, stride or form in distance running is not stereotyped. Relaxation, a low arm swing and no waste motion are the basic factors in proper form. The most important detail of good form, however, is *comfort,* for unless the athlete feels natural, he will not be relaxed or efficient. European distance runners usually run with a very slight forward lean of the body and a rather low knee action; they pay little attention to the arm action as long as it is relaxed and does not hinder the stride. They are not concerned about a high kick-up behind, as they feel the leg will swing down in a pendulum arc to a forward position without special effort to raise the leg forward.

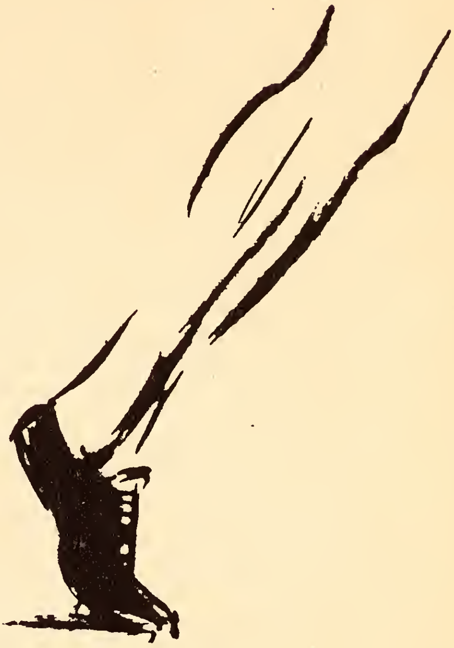
Contrary to some authorities, good distance runners *do not land heel first.* They *land* low on the ball of the foot.

They land low on the *ball* of the foot,





drop down on to the heel



then push off the toes.

It is a ball-heel-ball action.

There is only one way to develop efficient distance form, and that is to run—run—run. In most cases, the athlete soon learns that it is easier for him to perform if he attains the following:

1. Relaxation
2. Little forward lean
3. Low arm and knee action
4. Comfortable stride length

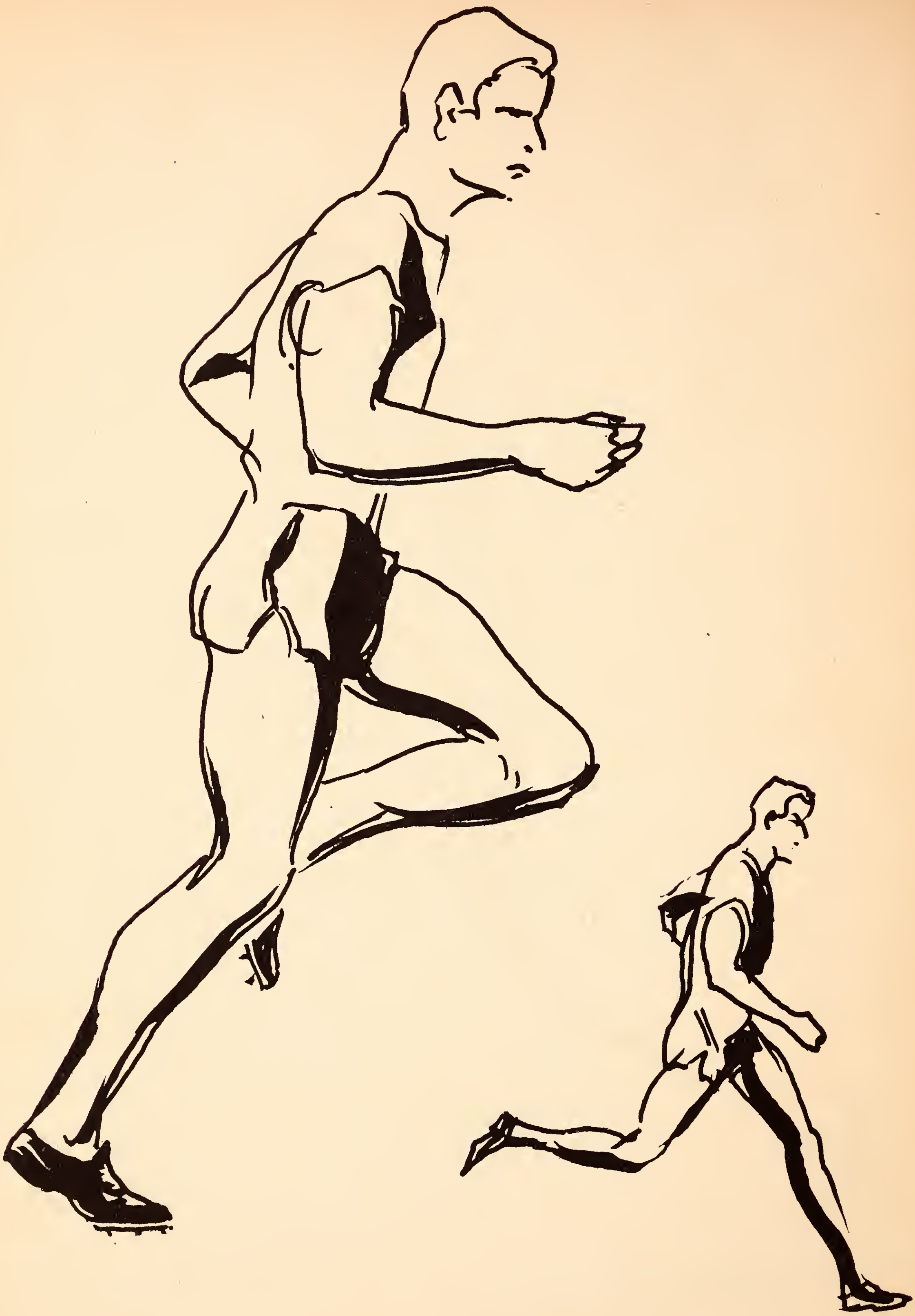
Before long he develops a style of his own that is both *efficient* and, what is more important, *comfortable* for him. Gil Dodds and Don Gehrmann cannot be classified as picture runners, yet an analysis of their styles will indicate very little waste motion and a comfortable style that has enabled them to perform close to capacity.

Breathing in distance running is done through both the nose and mouth on inhalation and exhalation. This is the most rapid manner for the human body to take in the needed oxygen.

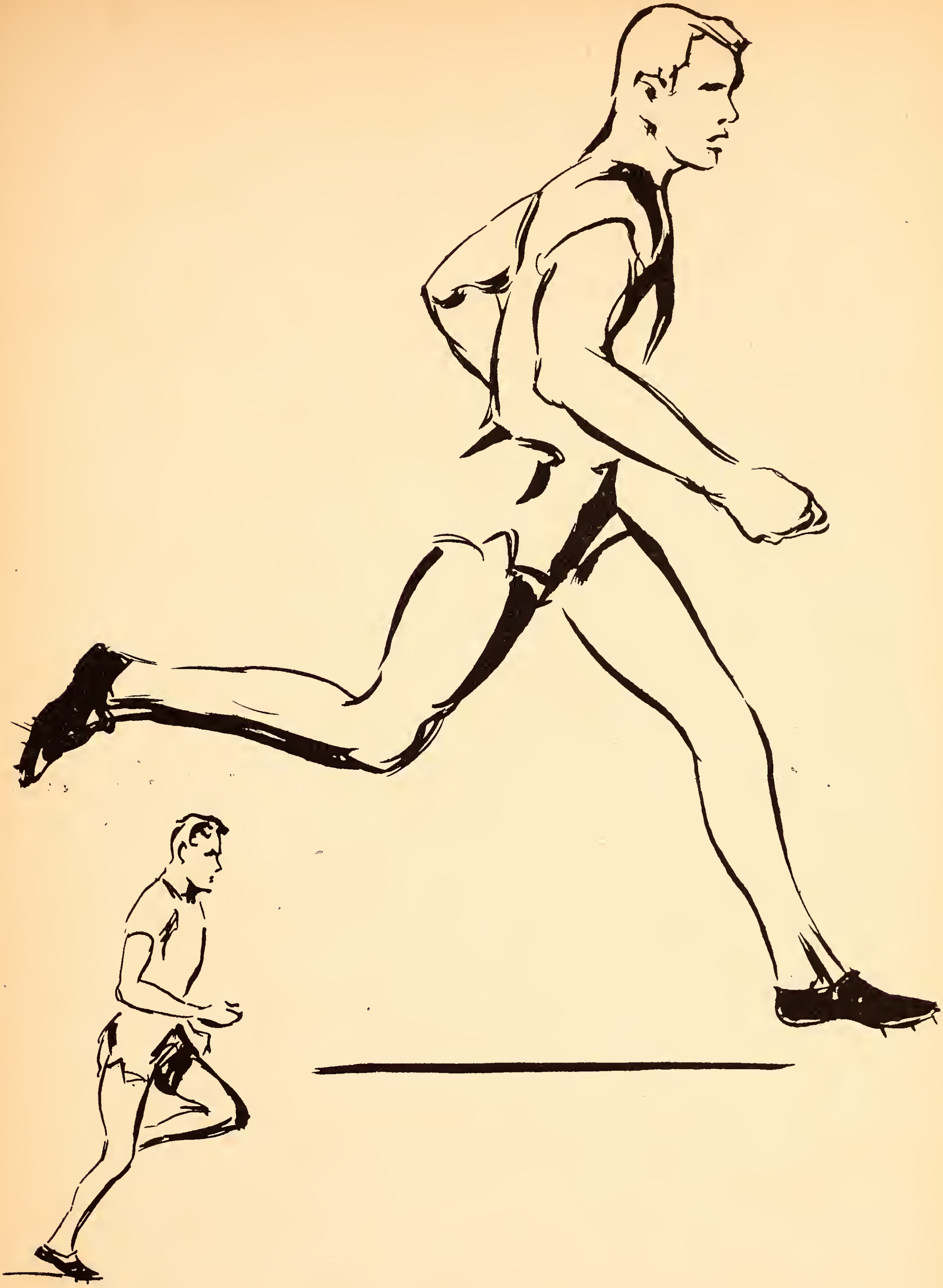
FORM ANALYSIS

On the following pages is a complete leg cycle of a typical American distance runner in action. The form or style for this particular runner is good, and the major fundamentals of form that most American coaches emphasize are pointed out. It should be mentioned that American runners differ slightly from most European runners in form and style. A comparison of the style and remarks concerning the foreign runners, made in the chapter on European cross-country techniques, will aid in recognizing the differences in the two styles of running and perhaps aid in understanding the basic principles of each.

All distance runners develop some of the rhythm, simplicity and comfort necessary for good performance if they run enough. Sound mechanics of form, however, may not come until a runner has a clear picture in his mind of just what he should do to effect economy in running effort.

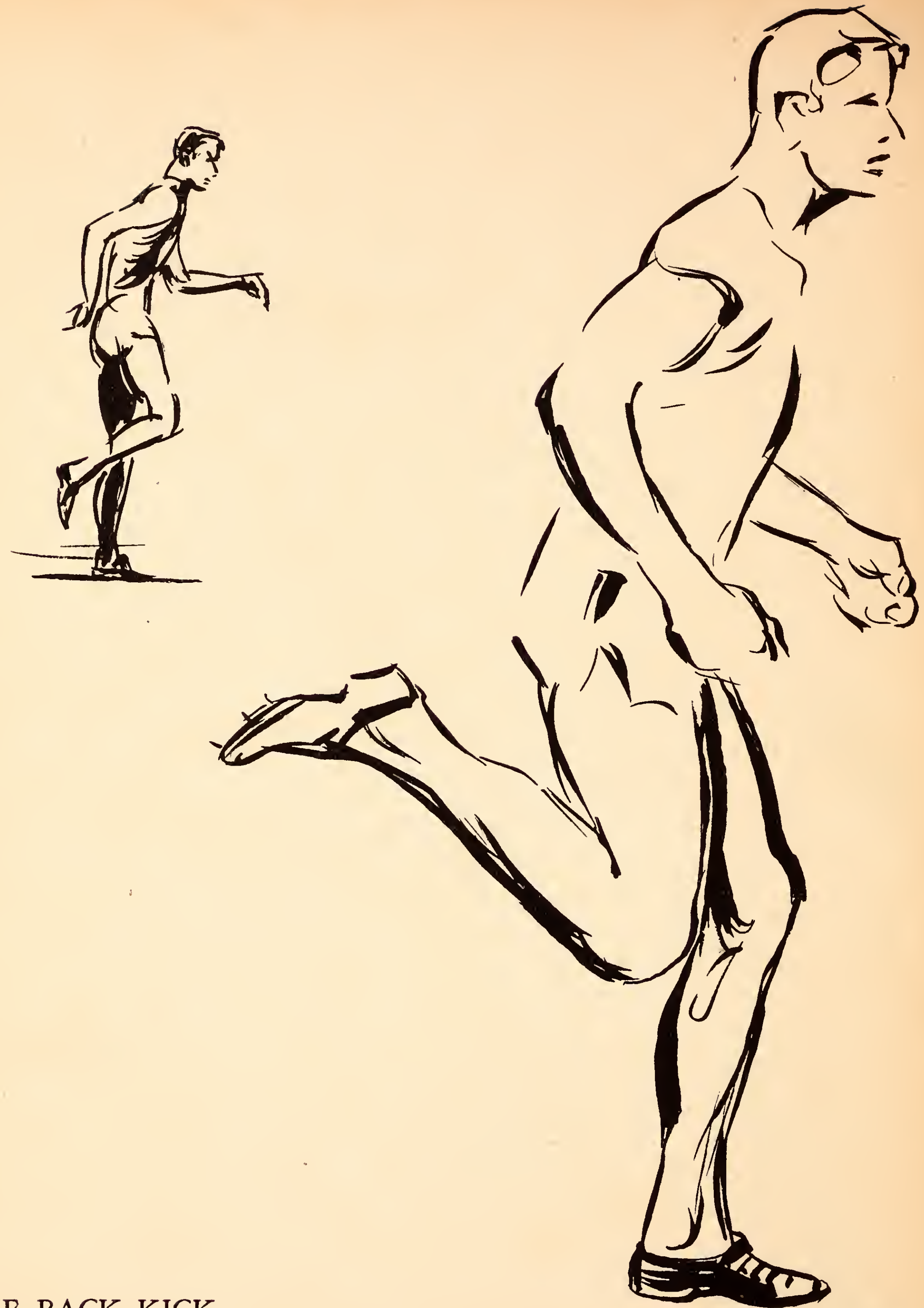


The distance runner's knee action is much lower than a sprinter's. Since, in cross-country running, great speed and a long stride are not required, but greater endurance is, the athlete uses a low knee action which results in a shorter stride and less speed. However, less energy is used with a low knee action, and this enables runners to run longer with less fatigue.



BODY ANGLE

Distance runners, in America at least, run with a *slight* forward body lean. A very erect body angle tends to shorten stride greatly, and because we place so much emphasis on leg speed and speed work, with the resulting longer stride, our distance runners usually carry this slight forward lean.



THE BACK KICK

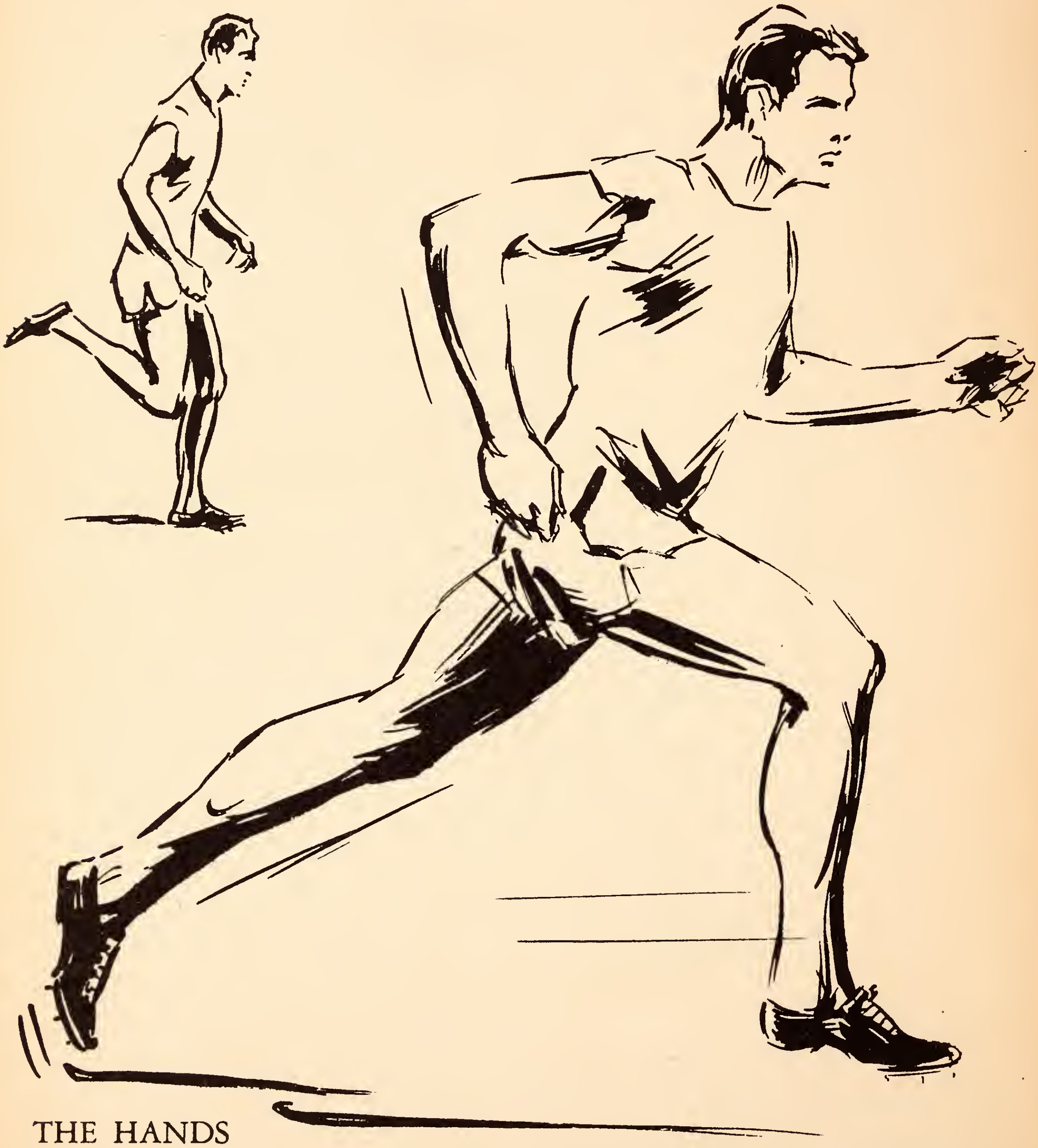
Many Americans feel that a distance runner *should be concerned* about a high back kick, as shown here. European runners, however, would disagree. It appears that some back kick is unavoidable for distance runners, as only a high knee action cuts down on back kick, and we have seen where a high forward knee action is not practical for distance runners. In general, back kick should not be a concern unless it is excessive. The runner here is carrying a reasonable back kick.

HEAD POSITION

One of the most neglected points of form of cross-country and distance runners is the head position. The simplest way to assume correct head position is for the athlete to fix his eyes on the ground some fifteen yards ahead. This usually keeps the chin down slightly, with the neck muscles relaxed. When fatigue sets in many runners throw their heads back, and nothing could be worse. Not only does it cause tenseness and alter the body angle, but it also makes it much harder to breathe just when more, not less, oxygen is needed.

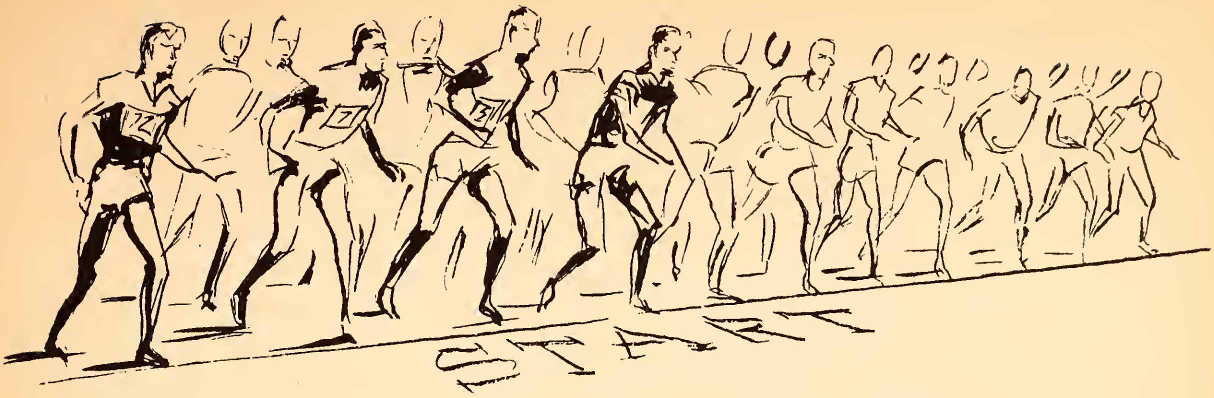
THE ARM SWING

When the athlete is striding, as above, the arms are almost at right angles at the elbow. The whole arm swings backward and forward from the shoulder, with the elbow angle remaining fairly constant. Arms are swinging in rhythm with the leg action, and the forward swing should not carry the hand above shoulder height, while the back swing of the arms should bring the *hands* about even with the back.



THE HANDS

The hands must remain relaxed and the wrists loose. By touching the palm of the hand with *only* the little finger, and cupping the other fingers, the athlete will find that he does not clench his fist so readily. The clenched fist, so detrimental to relaxed arm action, usually occurs when all four fingers of the hand touch the palm.

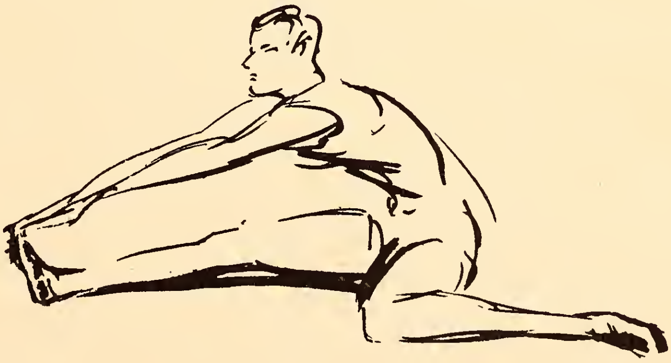


STARTING

While the crouch start is universally used in track meets, the *standing start* is used by practically every cross-country runner. Due to the length of the race, the cross-country runner usually doesn't have to get away from his marks like a sprinter. In addition, when the fields are very large (as in our National Collegiate and National A.A.U. meets) and hundreds often start the race, a standing position provides more stability where bumping and jostling are usually unavoidable.

The technique of the standing start is relatively simple. The athlete usually stands with the left foot just behind the starting line, and the right leg to the rear. The greater part of the weight is over this leading left leg, and when the gun sounds, the runner pushes from the left leg and brings the right leg forward for the first step.

The command given by the starter of a cross-country race is usually different than that used in track meets. The commands of "runners to the mark" and then "ready" followed by the gun are most often used in cross-country races.



THE WARM-UP

One of the most difficult problems the coach faces with youngsters is the warm-up prior to competition. The difficulty usually comes from the fact that youngsters simply do not have enough experience with the warm-up to understand its beneficial effect. It is safe to say that more than 75% of all high-school and college runners do not warm up properly. The business of teaching boys proper warm-up is further complicated by the fact that each has a different body mechanism, and very few men can warm up successfully with the same type and amount of work. Experimentation under meet and race conditions over a long period of time is the only way a distance runner can be sure he has the proper warm-up for himself. Even then, climatic conditions, uniform, the particular race and even physical condition may alter individual warm-up.

As a guide, however, the cross-country runner usually starts his warm-up a minimum of forty-five minutes before competition. Easy running until a sweat appears, with calisthenics, bounding and stretching, is usually the first phase of warm-up. Then, about twenty minutes before racetime a series of wind sprints is begun (the number and length of the sprints is an individual matter). Most athletes then rest in the dressing room or in a sheltered area, with their feet *slightly* elevated, until about ten minutes before racetime, when easy striding and jogging takes place. This is stopped about four or five minutes before racetime, so the pulse and breathing return to normal. The only further activity until the start of the race is light stretching and jogging in the sweatsuit to remain warm.

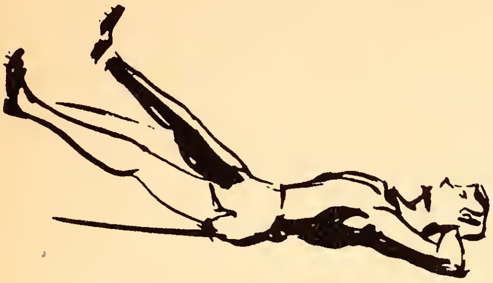
EARLY-SEASON PRACTICE

Regardless of the distance to be run, early-season practice should be *regular,* as little is gained by working one day and laying off while sore muscles rest. The beginner should realize that soreness is a part of getting into condition. To minimize stiffness, the first two or three weeks should consist of easy running, jogging and walking. The use of tennis shoes during this period eliminates much foot and leg trouble until some conditioning is attained. The running should gradually increase in tempo and distance until even the new runners do continuous running from ten to fifteen minutes, with no concern at all about carrying a fast pace. During this two- or three-week period of condition running the athlete should concentrate on four principal points. He should:

1. Experiment with warm-ups, try to determine what warm-up schedule makes running come easy.
2. Begin a concentrated calisthenic and body-building program.
3. Emphasize relaxation and comfort in all running.
4. Concentrate on *form* in *all* running.

The second stage of early-season training usually starts following the three-week period of informal running when the athletes begin to work regularly with a group and usually under a coach's guidance. During this period the program must be quite flexible due to varying physical conditions. The coach, for instance, would not give speed work to a boy with sore legs for fear of pulling muscles. He would also refrain from giving long work to a boy suffering with early-season arch trouble.

Following is a suggested twelve-day early-season training program for a high-school boy training for a two-mile cross-country race. (A college runner should get his schedule guide from the following chapter if preparing himself for a four-mile race.) It is wise to keep in mind, however, that no coach or advisor can set down a hard and fast program on paper, for such things as colds, blisters, etc., often dictate a change in schedule.



TWELVE-DAY EARLY-SEASON TRAINING GUIDE

1st Day	Warm up and exercise thoroughly. Work three miles on a soft surface, such as a golf course, by adjusting the pace so the distance can be covered without stopping. Rest ten minutes and run a moderately rapid 220. Jog and shower.
2nd Day	Warm up and exercise. Work again on a soft surface. Run two half-miles on the course at a comfortable pace with a ten-minute rest between them. Run a 440 at about three-quarter speed. Rest ten minutes, run a 220 at about seven-eighth speed. Jog and shower.
3rd Day	Warm up and exercise. Due to faster work yesterday, there will no doubt be sore legs. Run again on a soft surface and run for twelve minutes without stopping, trying to run at a faster pace than used on the first day. Run a comfortable 220. Jog and shower.
4th Day	Warm up and exercise. The first attempt at learning pace should start. Run three quarters of a mile on the course or track trying to run as close as ability permits to 4 minutes and 7 seconds if an 11:00 two-mile is the eventual goal. Rest ten minutes, run a half mile as close as possible to 2:45. Run a 220 faster than race pace. Jog and shower.

5th Day	Warm up and exercise. If legs are not sore, run six quarter-miles with a ten-minute rest between them at race pace—about eighty-two seconds if a 5-minute 30-second mile is within the capabilities. End up with a rather fast 220. Jog and shower.
6th Day	Warm up and exercise. Run a one mile and one half at what has been determined as race pace. If a 5-minute 30-second mile is possible this early, run the one and one-half miles in 8:15. Rest ten minutes, run a 440 faster than seventy-five seconds. Rest ten minutes, run a 220 faster than race pace. Jog and shower.
7th Day	A long walk or complete rest depending on how you feel.
8th Day	Warm up and exercise. Take a long work-out on the course, consisting of twenty-five minutes of running, jogging and striding. Rest ten minutes, run a good 220 on the track. Jog and shower.
9th Day	Warm up and exercise. Run three half-miles with ten minutes' rest between them, all *slightly faster* than race pace. Rest ten minutes and run a good 220 on the track.
10th Day	Warm up and exercise. Run the first mile of the cross-country course in as close to 5:30 as possible (if aiming for an 11:00-minute two mile in the coming meet). Run a paced quarter on the course. Jog and shower.
11th Day	Take a walk or rest completely.
12th Day	Warm up and exercise. Run a two-mile time trial on the cross-country course, with a 5:30 time on the first mile. Ten minutes after the end of the race, do some wind sprints. Jog and shower.

LATE-SEASON PRACTICE

As the season progresses most college coaches refrain from running the athletes at meet distances during the week. Instead, the generally accepted practice is to work "over" meet distance one day, and "under" meet distance the next day. The practice of running hard too often at the meet distance creates boredom in the athlete and does not provide the psychological build-up for the meet race that "over" and "under" work seems to do. High-school coaches, however, have found that running at the meet distance during the week has value. They are confronted usually with inexperienced runners who have little competitive background, and the only way these boys usually get confidence in a two-mile race is to run it many times during the fall. It takes much running for a boy to "feel" a race, and until he builds up a competitive background over the course to be run there seems to be much value in his going through the distance from time to time during practice. The best time to work over the exact distance during practice is at least four days prior to a meet. As the season progresses this practice is very often discontinued in favor of emphasis on underdistance and pace work.

As the season progresses the athletes and the coach can best decide what the relatively new or beginning runner needs. There are so many factors affecting the way a boy (or group of boys) is handled that only a guide for workouts after competition begins can be shown. One of the greatest variables is the frequency of competition. Many high schools race Mondays and Saturdays, others just once a week, so when planning midseason practice, a schedule first must be worked around the meet schedule. It seems wise, however, to base it on the following principles:

1. Some overdistance at *slower* than race pace to build *confidence* and *strength.*
2. Some underdistance at faster than race pace to build *strength* and *leg speed.*
3. Pace work at various distances *under* the meet distance for pace knowledge and feel.

Below is an outline for the coach to use in developing a practice schedule during late season. It is designed for a team having only Saturday meets. Where this is not the case, adjustments should be made. Notice that rest precedes all meets and a long walk follows all meets.

LATE-SEASON TRAINING GUIDE

Monday	Overdistance work on the course. Working in a group, with no effort to race or run hard for time. Have fun this practice. Finish up with light speed work.
Tuesday	Pace work on the course or on the cinder track. Finish up with 220's (3).
Wednesday	Run through half of the race two or three times on meet pace. Finish up with 440's (2).
Thursday	Easy long work as a warm-up. Then run several (2 or 3) 440's on meet pace.
Friday	An easy warm-up or rest.
Saturday	Meet.
Sunday	A long walk if weather permits.

TIPS TO ATHLETES

1. Never quit. Always finish a practice, a trial or a meet no matter how much you feel you are punishing yourself. Develop the "staying" power rather than the "quitting" habit.
2. After a race or hard running never fall to the ground, sit or lie down. This action indicates either that you have not trained properly or that you are trying to attract attention to yourself. Jogging and walking around after running brings on quickest recovery.
3. Always attempt to stay up with the better runners a little longer each time you run. That is the only way to show constant improvement.
4. Always practice in groups. The boy running alone simply does not work as hard as he does when running with others.
5. Master pace and constantly *think* in terms of increasing the rhythm and the rate of running.
6. A day off from practice (for the beginner especially) is only delaying conditioning. Never miss practice if you aspire to be a great runner.
7. Be very cautious in foot care. Blisters and minor foot injuries are common in cross-country, and without immediate care they may become quite serious in a short time.

Chapter V

ADVANCED CROSS-COUNTRY TECHNIQUES

When cross-country competition reaches the college and club level, the distances most commonly run are four, five and six miles. The national collegiate championships are run at four miles, and the A.A.U. championships are at 10,000 meters (six miles and 376.11 yards).

Some of the greatest names in track and field are found among the winners of our national cross-country championships. Don Lash, Gil Dodds, Walter Mehl, Greg Rice, Horace Ashenfelter and Fred Wilt are men who took this fall sport seriously enough to become champions over the hills and dales. Due to the approach of these athletes and their coaches, America has recently made great strides forward in training methods necessary for major competition in distance running and cross-country.

ATTRIBUTES FOR SUCCESS

Championship performance in cross-country and distance running on the track involves four vital, highly developed individual factors. They are:

1. Strength
2. Speed
3. Technique
4. Courage

One without the other is of little value to the boy who aspires to be a champion. In fact, performing even close to capacity is virtually impossible unless all four of the above components are present in the athlete to a marked degree. While some success may be enjoyed by the distance runner with little speed, the champions and near champions all have the ability to carry a reasonably fast pace. Of course, the boy who has not built up his strength and courage and mastered technique has little chance for success in even average competition.

It should be evident that all four components are interrelated to such a degree that it is virtually impossible for one who runs and trains seriously not to develop all phases to some extent, but it should also be evident that well-directed training can place emphasis where it is most needed. No two athletes possess the same qualities, and thus no two training programs can ever be exactly the same. Some boys are nearly form-perfect, others need much work. Many may have fine speed and others have great strength, all have some courage, and yet all can develop more. It is well for every distance and cross-country runner to remember that the one athlete possessing the ultimate in strength, speed, form and courage has not yet appeared. The constant raising of personal sights and ultimates must continually be carried on by every coach and athlete.

Physical requirements for college cross-country runners are no different than those for high-school runners. Candidates must have special mental as well as physical capacity. The key to good distance running is the ability to overcome the "feeling of being tired," which always precedes actual physical fatigue. A clear, alert mind has less difficulty discriminating between real fatigue and mental fatigue. As for physical characteristics, the majority of distance runners are of slight build and usually short in stature. A relatively slow heartbeat is of a physiological advantage, but it is the tenacious will and the ability to drive oneself that makes the successful distance runner. He must have a tremendous capacity for work, and this, plus strict adherence to simple training rules, is the foundation upon which good distance runners grow.

AMERICA'S TURNING POINT

Since the heyday of Billy Hayes the training of American cross-country athletes (as well as distance runners on the track) has improved rapidly. Mr. Hayes, who absorbed most of his distance-running knowledge in the Scandinavian countries (and particularly in Finland), applied what he learned abroad to the situations faced by our distance runners. The results were a combination of strength, speed and mental preparation far beyond what our coaches were then achieving. Today it is interesting to note that most of America's consistently successful distance-running coaches have followed the principles set down by Billy Hayes. Their programs have been refined and many of their own progressive ideas have been incorporated into their advanced training programs.

CAPACITY FOR TRAINING

Advanced techniques of training are based mainly on the principle of more and harder work. Almost without exception distance runners today have found that they can and do follow a more concentrated work program than runners of even a few years ago. *While it may sound callous, the success of a distance runner depends to a great degree upon his capacity for taking work.* It is not uncommon today to find many of our successful American cross-country and long-distance runners working out twice each day. Mr. Hayes, for instance, on many occasions had his great athletes running over the hills in the early morning and again in the evening. While twice a day workouts are *not* usually possible for

students in school, such fine runners as Fred Wilt, Curtis Stone and Horace Ashenfelter have used them during their post-graduate running careers.

Naturally, poorly directed hard training can do much more harm than good, and in discussing the additional running that most college boys do in their cross-country training many factors must be included.

It might be mentioned that in different sections of the country some high schools and colleges substitute a team race on the track for cross-country competition, usually to allow football spectators to watch the

race during half time. Actually this is a poor reason for running such a race, not to mention the fact that it defeats the main purpose of cross-country running. But it must be admitted that even a program such as this is more valuable than none at all.

In these cases the training schedule for a two miler, as explained in "Track Techniques Illustrated" of the Track and Field series, seems more practical to follow.

TYPE OF TRAINING

Whether the athlete is preparing for the competition of four miles or more, or a shorter race of one or two miles, he should begin preliminary work six weeks to two months in advance of competition. When the time comes for actual planned practice it should consist of three types:

1. Underdistance at a faster than race pace.
2. Overdistance at a slower than race pace.
3. A great deal of pace work.

As indicated in the previous chapter on beginning cross-country running, repeated speed work plays a very important part in the distance runner's training schedule. One of the real dangers of *excessive* overdistance running is a slow pace, and the resulting development of a slow rhythm that the runner is either *mentally* afraid to increase or *physically* unable to step up. Constant work on speed assists in sustaining a more rapid pace when it is demanded. Overdistance work is one method of building strength and endurance, and, without question, it is necessary for the *mental* assurance it provides the runner. A distance runner could no doubt be trained and developed physically by a proper schedule of repeated speed work. However, underdistance work alone does not give the athlete the feeling that he can "go the distance" that longer work provides.

CONSERVING ENERGY

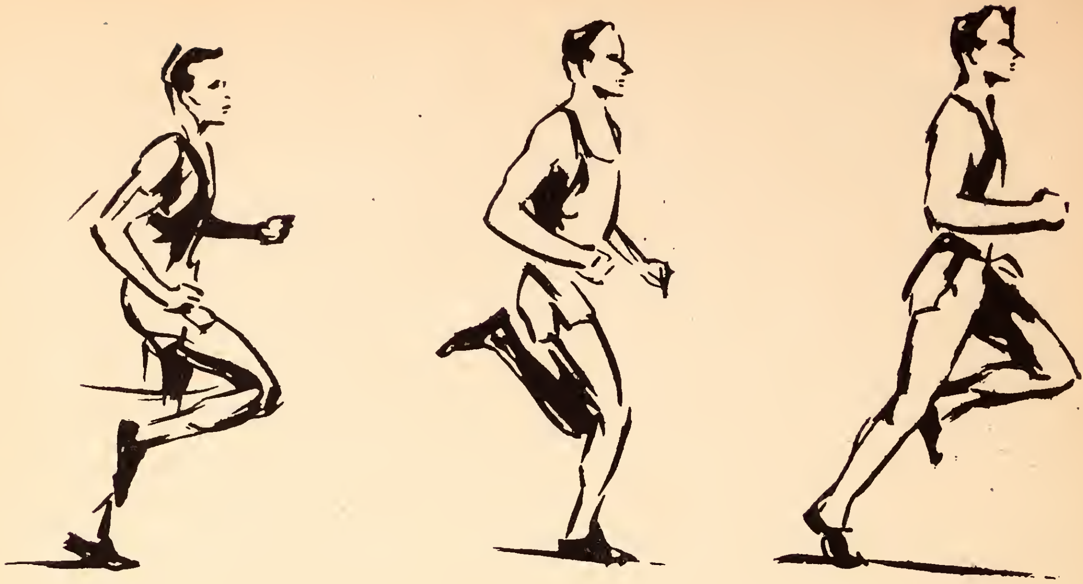
The athlete must develop the ability to run on a given schedule, for if there is a secret to distance running it is the ability to distribute energy equally over the distance to be covered. When the athlete masters pace running, experimentation with varying pace is the only way to determine what actual race pace he should use. To avoid monotony and the consequent feeling of fatigue, some coaches advocate a slight change of pace, or "checking out," during the actual race (discussed in detail in Chapter VI). Others use the device of saying something to the runner during the race to occupy his mind. Whatever the method, the effort to take the athlete's thoughts away from the grind of long rhythmic running is important.

GREATER EMPHASIS ON SPEED WORK

The older and stronger runner naturally is a better judge of pace than the beginning youngster. For this reason the coach and athlete can usually spend more time on the repeated speed work phase of advanced training. Tom Deckard, a great distance champion, once told the author that Billy Hayes often required him to run five or six half-miles during a single workout in 2:05 or better. This repeated speed work (for a four miler) requires not only great strength, but also traveling at a rate of speed much faster than race pace. A single workout thus took care of both endurance and speed requirements. It is also of interest to note that Emil Zatopek, of Czechoslovakia, the greatest distance champion in track history, trains completely on a repeated speed program. He can be found daily on a cross-country course (sometimes as often as three times a day) running repeated quarter miles. John Ross and Fred Wilt report after talking with Zatopek that he has run as many as sixty 440's during one day. While such a program as this is considered impossible for the average American runner, it does indicate the emphasis placed on repeated speed work and the fantastic amount of running in the background of the world's greatest distance runner.

REST AND ENTHUSIASM

One of the most significant contributions made by Billy Hayes with his great distance runners was his finding that men like Lash, Deckard, Smith, Trutt, Wilt, Kane and Hornbostel would *progress* under the hard-



est work schedule imaginable as long as they did not work three days in a row. For this reason, Mr. Hayes *never* gave his men strenuous work following two days of hard competition or practice. The third day was always used to recover vitality and strength. At Michigan, at least, our experience has been quite similar to that first revealed by Mr. Hayes. When an athlete does not have enthusiasm for the following day's work, it is evident that his training has been too strenuous the day before.

The problem confronting the coach and the experienced runner is that despite emphasis on hard work, there should *never* be a workout prescribed or attempted that lies beyond the athlete's capacity. Morale in distance running is a delicate thing, and often a coach's ambition and desire to push a boy will pile on too much work. When this occurs, the psychological build-up from day to day and from week to week can be destroyed in a single workout that is beyond the physical capacity of the athlete. It is much wiser to prescribe a little less work than ambition indicates than to give a youngster a schedule that is physically or mentally beyond his present capacities.

DEVELOPMENT OF COURAGE

The courage so necessary for outstanding long-distance running, despite what many claim, can often be given to a boy by a wise and cautious trainer and coach. Fears and lack of courage are usually based on ignorance and an unfamiliarity with a given situation. The distance runner often is timid about carrying a fast pace because he has not found out just how strong he really is, and because he has not planned his race pace properly. The phenomenon of an average runner suddenly blossoming into a fine performer is quite often due to the sudden understanding of the problems at hand and the resultant urge to meet them. He suddenly seems to develop courage, when the fear of fatigue and the apparent inability to finish have disappeared through a well-directed training program, one that has:

1. Built confidence by progressive successes during practice.
2. Taught that *even pace* is far less fatiguing than random pace.
3. Shown that every runner has great wells of strength that he never taps.
4. Proved that *real* discomfort during a race is not only bearable, but actually of short duration.

PACE-PACE-PACE

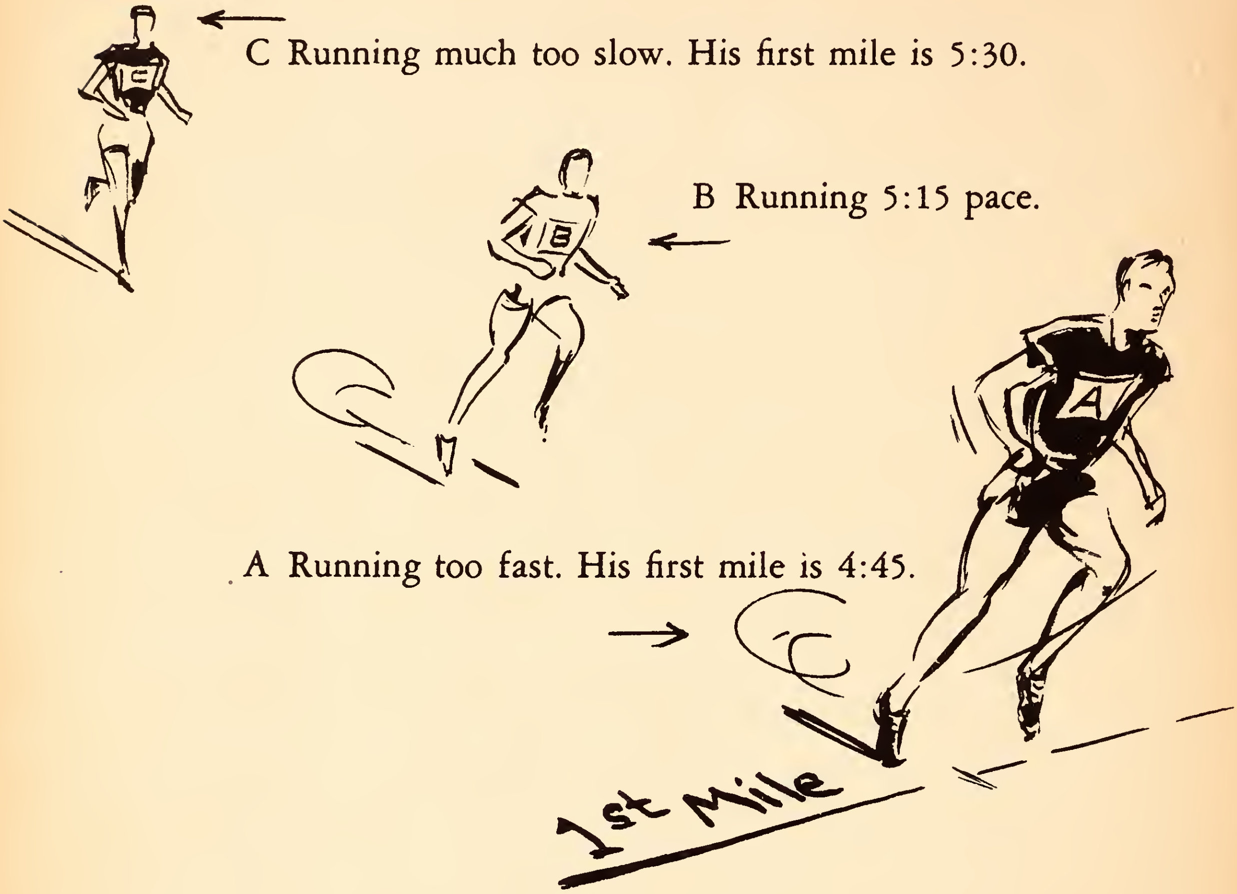
It has been stated many times that the secret of cross-country and long-distance running is "pace" or the proper distribution of energy over the distance to be covered. We have all watched long races over the hills and seen certain runners pack in remarkably fast finishes of one hundred or two hundred yards in length.

The runner with the tremendous finishing "kick" after a long race usually draws the spectator's applause regardless of where he finishes. But such a finish is often made by an athlete who, through lack of planning or poorly directed training, has failed to distribute his energy properly throughout the race. The runner's first concern should be an even pace throughout the race, and he should simply put all the energy he has into the finishing sprint when the end of the race nears. He shouldn't count on the sprint to win the race for him. A man with strength *who has pace knowledge* can often take the speed out of a "kicker" during the body of a race.

Racing tactics in a long-distance run are less important than those in a shorter race, because the field after a few hundred yards is usually not bunched, and there is more time to recover from errors made during the race. Alertness, however, is vital. Pace, position and running room must be maintained. The manner in which the race develops should determine at what point the athlete should start his sprint to the finish. Athletes with speed may find it wise to lay back until the final stretch. The stronger men may have to pick up the pace with little more than half the race over.

The college athlete who is aiming for a twenty-one-minute four mile must run as close as possible to four 5:15 miles. He must be cautious about not being drawn out too fast during the first half mile of the race as men tear from the marks to get position, and he must also be especially cautious about the third mile of the race where the pace is most likely to become slow. Constant running at race pace during practice soon familiarizes an athlete with his proper pace. It should also be constantly borne in mind that a front runner (one who sets the pace) who usually runs about 5:15 pace should, when he runs behind a superior athlete, be able to carry a faster pace. The phenomenon of boys running far better than ever before usually occurs when they are following someone else with no worry about the watch or breaking the wind.

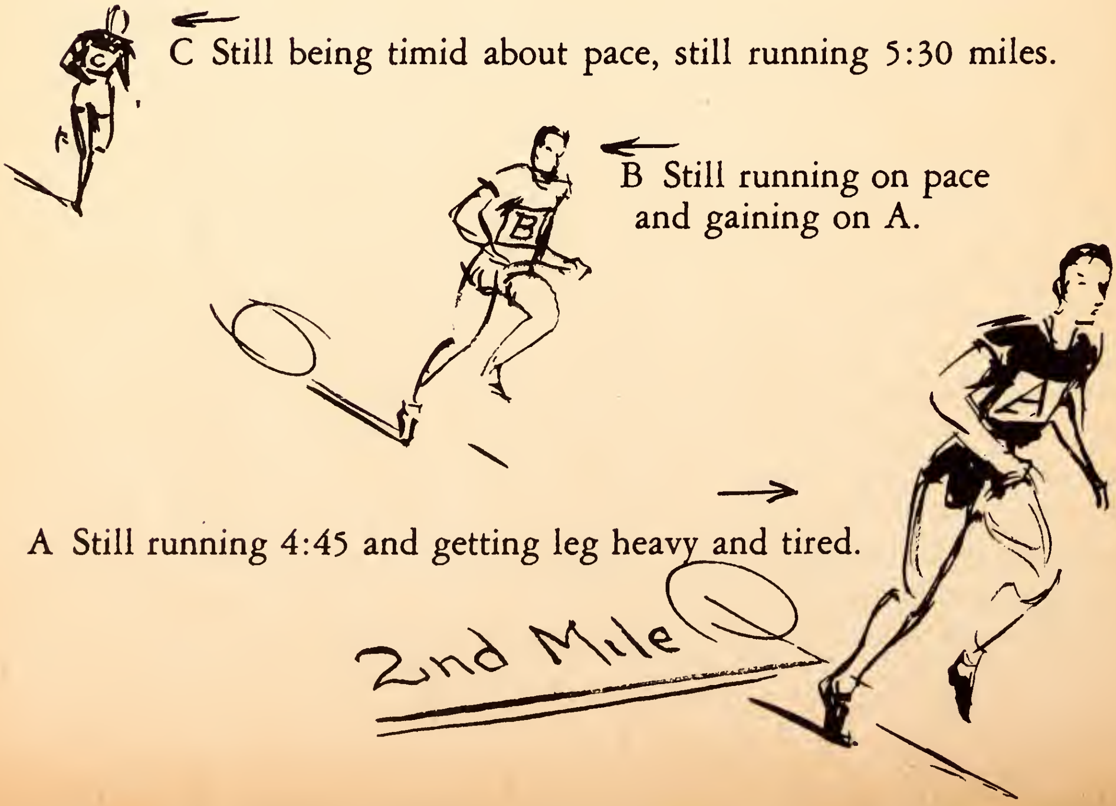
Following is a four-mile race between three men of equal ability. They are all capable of a 21:00-minute-flat four-mile race. Notice, however, that poor planning on the part of A and C have resulted in substandard performances, while B has run proper 5:15 pace (thereby distributing his energy properly) and has become an easy winner.



C Running much too slow. His first mile is 5:30.

B Running 5:15 pace.

A Running too fast. His first mile is 4:45.



C Still being timid about pace, still running 5:30 miles.

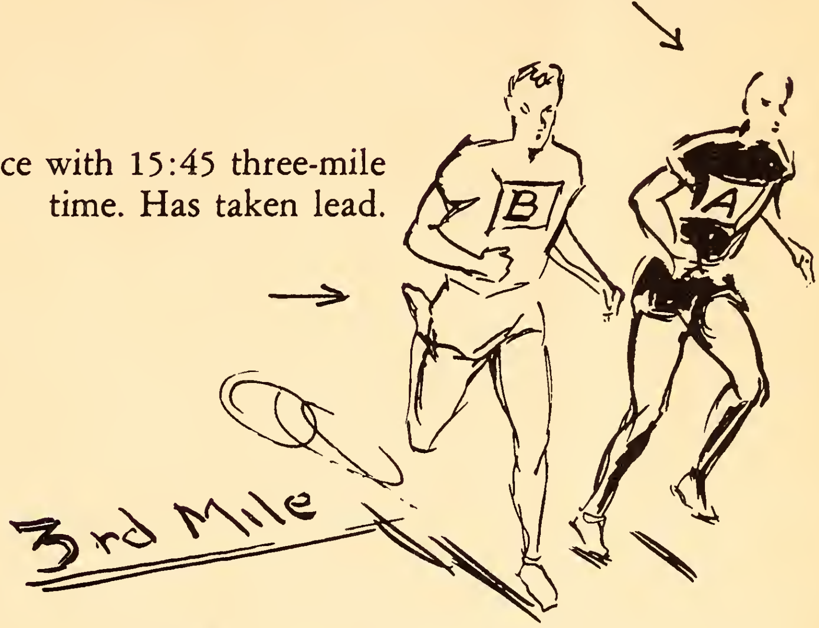
B Still running on pace
and gaining on A.

A Still running 4:45 and getting leg heavy and tired.

C Still not forcing himself to get tired. His slow pace has lost the race.

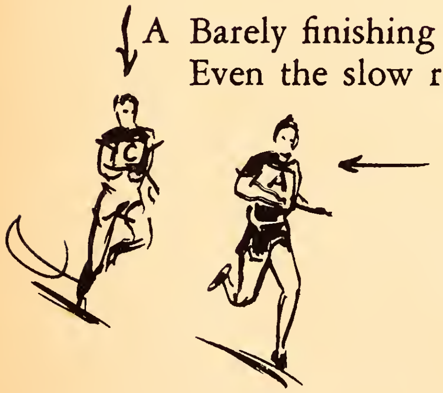
A Now very tired and B has caught him.

B On pace with 15:45 three-mile time. Has taken lead.

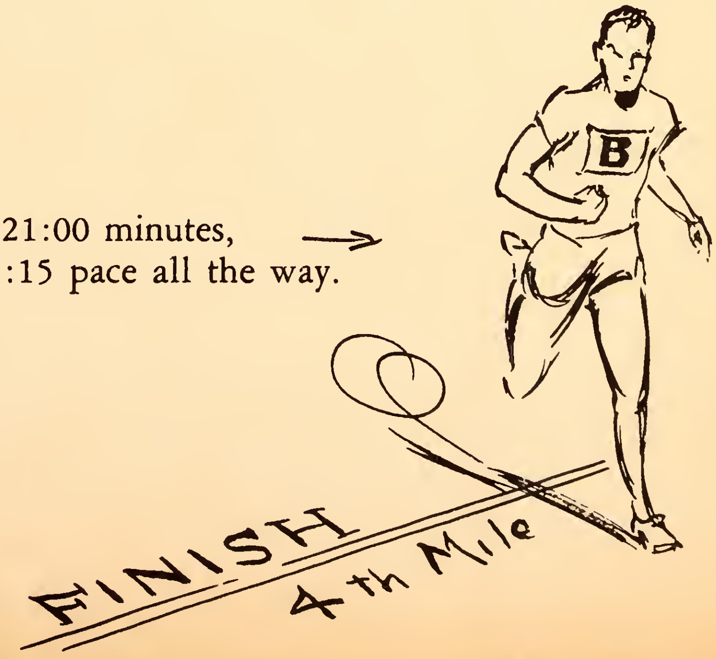


C Due to slow pace finishing strong, but was so far behind he couldn't win.

A Barely finishing due to fast early pace. Even the slow running C catches him.



B Wins easily in 21:00 minutes, after running 5:15 pace all the way.



DETAILS TO CONSIDER

The college runner, like the high-school runner, must decide at the outset that he will practice *regularly.* It is impossible to progress to maximum efficiency if practice is on a hit or miss basis. It is far more sensible to work a little each day over a long period than it is to work very hard over a short period of time.

Preparation for a four-mile cross-country race requires weeks rather than days of preliminary work. It involves getting sore muscles and the inevitable discouragement when wind is short. During the preliminary two- or three-week period when men usually run to get some conditioning before official practice starts, the runner must review his warm-up, calisthenic program, form and ability to relax. Regardless of past experience, it may be wise for each coach and athlete to go over the preceding chapter on beginning cross-country to bring to mind again the basis upon which all good performance is built.

Following the three-week period of informal condition-running the athlete starts work on his group running, usually under a coach's guidance. Here is a twelve-day early-season program for an athlete preparing for a season in which a four-mile race is usually run. It must be realized that it is impossible for a coach or an advisor to outline a hard and fast program on paper. Colds, blisters, the weather and many other factors usually dictate a change in schedule.

TWELVE-DAY EARLY-SEASON TRAINING GUIDE

1st Day Warm up and exercise thoroughly. Run for a half hour in a group, jogging and walking some if the pace carried early is too fast. Rest about ten minutes and run a 440 at about three-quarter speed. Jog about ten minutes to cool off, and then shower.

2nd Day Warm up and exercise. Work over the course. Run two individual miles at a comfortable pace, with a ten-minute rest between them. Run a half mile at about three-quarter speed. Rest again and finish up with a 440 better than seventy seconds. Jog ten minutes and shower.

3rd Day Warm up and exercise. Due to faster work yesterday, the legs may be a little sore. Run again on a soft surface, covering about five miles, relaxed and easy jogging, and walk a little after each mile. Do no speed work today. Jog ten minutes and shower.

4th Day Warm up and exercise. Pace work should begin today. Run a mile as close as possible to 5:15 if twenty-one minutes is the goal for four miles. Rest and run another 5:15 mile. Run a half mile about 2:37.0. Finish up with a 440 better than seventy seconds. Jog ten minutes and shower.

5th Day Warm up and exercise. If legs are not sore, run six half-miles at race pace. For the twenty-one minute four miler the halves should be run in 2:37.0. This workout may be taken on the course or on the track. End the workout by doing four or five wind sprints. Jog ten minutes to cool off. Shower.

6th Day Warm up and exercise. Run three miles at what has been determined a preliminary four-mile race pace. If 5:15 pace is possible, run the three miles as close as possible to 15:45.0. Rest ten minutes and run a 220 under thirty seconds. Jog ten minutes to cool off. Shower.

7th Day Take a long walk through the woods or over a soft surface such as a golf course.

8th Day Warm up and exercise. Run over the course for about forty-five minutes. Jog and stride at a slower pace if necessary. Make an effort to do more running and less walking than was done on the first day. Rest ten minutes and run a 440 better than sixty-five seconds. Jog ten minutes and shower.

9th Day Warm up and exercise. Run three individual miles with a ten-minute rest between each mile. They should all be slightly faster than race pace. If twenty-one minutes is the four-mile goal, run these miles in five minutes or a little better. Finish the workout with a 440 better than sixty-five seconds. Jog ten minutes to cool off and shower.

10th Day	Warm up and exercise. Run the first two miles of the course at race pace. Rest ten minutes and run the last mile of the course *faster* than race pace. Run a good 440 on the track. Jog and shower.
11th Day	Take a walk or rest completely.
12th Day	Warm up and exercise. Run a four-mile time trial on the cross-country course. Finish the day with four or five wind sprints. Jog ten minutes and shower.

As the season progresses, most college coaches never run time trials at the four-mile meet distance. Instead, the generally accepted practice is to work overdistance early in the week and underdistance toward the end of the week. The practice of running four miles on the watch outside of competition on weekends is a sure way to bring on boredom with distance running. Challenging practices at off distances during the week seem to keep the athletes more stimulated, and they are more liable to "key up" for. a greater effort at the four-mile distance when meet-time rolls around.

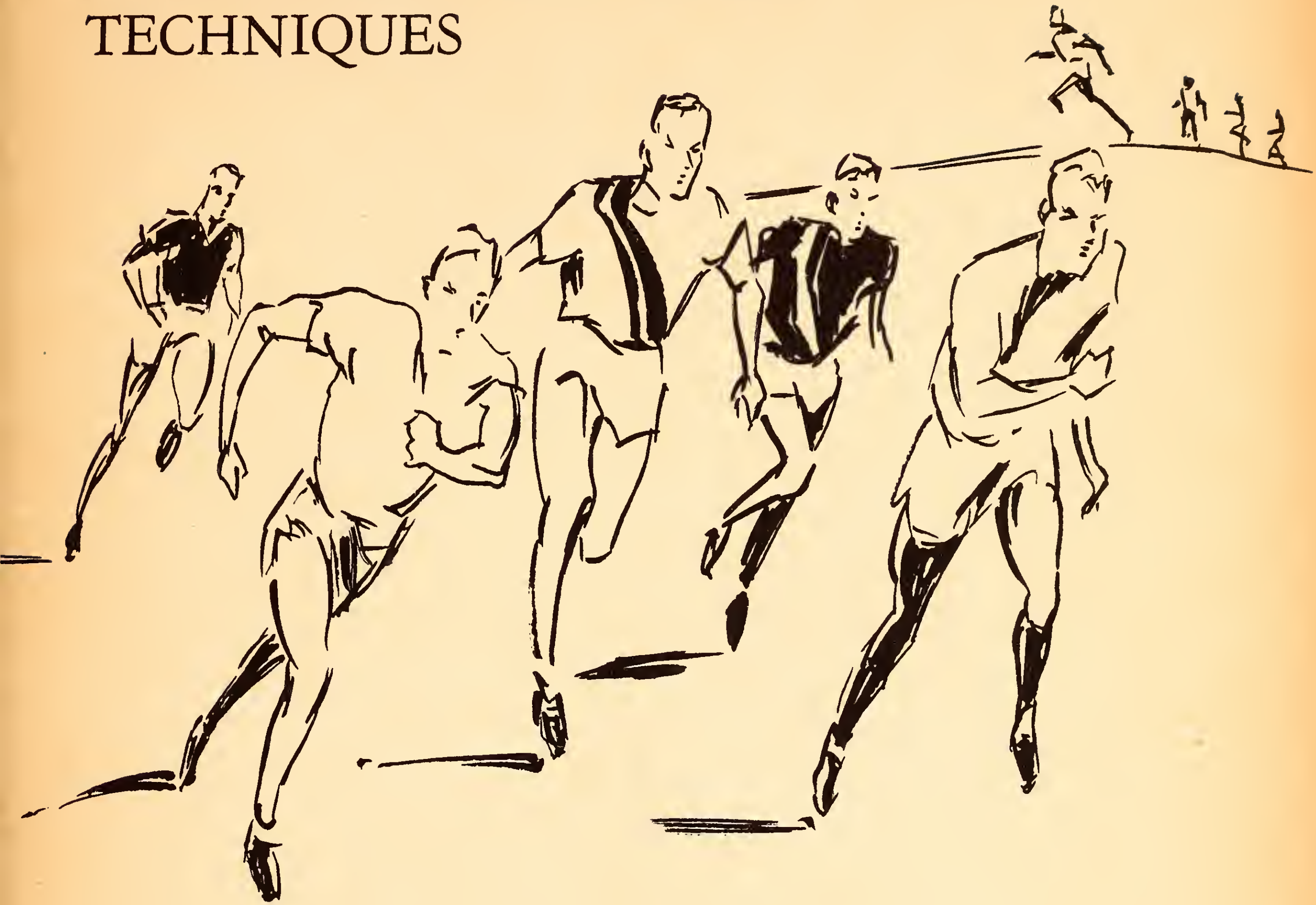
The coach and athlete should do considerable thinking about what is best for each individual as the season goes along. In any case, the first order of business is to work the practice schedule around the meet schedule. Following is a suggested guide to be used in planning a mid- and late-season program.

MID- AND LATE-SEASON TRAINING GUIDE

Monday	Work long and easy on a golf course or some other soft surface. Hard running should be avoided, and an attitude of recreation should be maintained. Finish up with light speed work.
Tuesday	Pace work on the course or on the track. Finish up with light speed work.
Wednesday	Repeated work at 880's or miles. Finish up with speed work.
Thursday	Easy long work as a warm-up, or light pace work. Finish up with *light* speed work.
Friday	An easy warm-up or *rest.*
Saturday	Meet.
Sunday	A long walk if weather permits.

Chapter VI

INDIVIDUAL AND TEAM TECHNIQUES



Paavo Nurmi, of Finland (the "Phantom Finn"), more than any other man caused Americans to realize the "details" necessary for successful distance running. Nurmi's emphasis on every possible technique involved in training and competition was the greatest single factor in both European and American realization that there is much more to successful distance running than strength and speed.

Like all great distance runners, Paavo Nurmi did a great deal of work on the cross-country course. In fact, he won the 1920 and 1924 Olympic games 10,000-meter cross-country race when that event was part of the Olympic program.

Since Nurmi first showed Americans the great attention to detail necessary for championship performance, our coaches and athletes have come a long way. Today the great distance runners are not accidents. They are the results of painstaking research, study and experience. This attention to detail has given us a very promising future for distance running.

In cross-country running the serious coach and athlete must consider many individual and team techniques.

THE RUBDOWN

One of the most overrated devices of this sport is the pre-meet rubdown. Yet, it is surprising how many athletes do not understand it or its place in their training program. The main function of a rubdown is to assist (by massage) the body tissues in clearing themselves of waste matter. For this reason, a rubdown has much more value following competition than prior to it. In rubbing an athlete, the stroking should always be toward the heart to assist in carrying the waste in the muscles out of the extremities.

The selection of liniments for pre-meet application is important, and for the cross-country runner the use of rubbing alcohol is *not* good procedure. Alcohol evaporates quickly, chills the skin and leaves it cold. On cool fall days this is hardly beneficial. Alcohol further removes the normal protective skin oils. A "warmer" liniment should be used as a lubricant for cross-country runners. There are many on the market that will slightly inflame the skin, bring blood to the area, and thus create a feeling of warmth rather than a cool feeling as pure rubbing alcohol does. It must be remembered, however, that no muscle can be really warmed by any liniment. Muscles are only warmed and made ready for use by physical work.

PACE RHYTHM

The basis of technique in distance running is in the advantageous distribution of the runner's energy. A well-planned pace is the key to this distribution of energy and can be developed by much rhythm running on the stop watch. A boy planning to run five-minute miles can only learn how a five-minute mile feels and how long he can hold the rate of speed by constantly running at this pace during practice. Just as the ideal way to run a four-minute mile is through four sixty-second quarters, the most efficient way to run four miles in twenty minutes is by running four five-minute miles.

The individual race often makes pace running quite difficult because the course is usually not flat and smooth. It should be obvious that the boy who has learned to run pace up to his capacity will usually be able to perform closer to his potentialities over any surface, than the boy who has not learned pace and rhythm.

STRIDE AND FORM

Stride and form have been discussed in detail in the previous chapters, but several points of technique may be considered after the athlete has learned to run comfortably without wasted effort.

Cross-country runners as a group tend to *overstride* rather than understride. A rule of thumb is "the longer the distance, the shorter the stride." The boy who bounces as he runs is usually the one who wastes energy by a long bounding step rather than conserving it by shorter effortless running. If a "bounder" will merely raise his toe slightly just before the lead foot hits the ground, he will land lower on the ball of his foot and thus eliminate bouncing and sometimes the resultant overstriding. Boys who *constantly* complain of sore calves during cross-country may well be running too high on the toes, and they too can usually solve their problem by merely lifting the toe.

RELAXATION

Relaxation is always a major factor with the cross-country runner. Cool weather, monotony and just plain tiredness often cause athletes to become tense, whereas a little precaution might eliminate this tendency. The distance runner usually shows the first sign of tenseness in his hands and then his arms. Clenched fists due to habit, or coldness, are a sure invitation to tightening in the upper extremities. Constant emphasis on relaxed wrists and hands during practice, the wearing of gloves on cold days, and the occasional dropping of the arms during a long race (to promote circulation) often forestall tenseness. The wearing of T-shirts rather than regulation track shirts keeps the shoulders and armpits from chilling, and most cross-country teams have now turned to the T-shirt.

Running several different courses in practice will minimize monotony and often create new enthusiasm. Relieving the boredom of practice work goes a long way toward promoting relaxed running.

COMBATING FATIGUE

There is no way to be successful in cross-country running without getting tired. There are several things that the athlete can do, however, to fight off this feeling of tiredness. He should:

1. Rest before the race. No hard running two days prior to a big meet.
2. Keep an alert mind and constantly try to think of something that will eliminate "going to sleep" mentally.
3. Change the running *form* for a few strides to relieve muscle groups doing a great amount of work. Changing the body angle is a simple way of doing this.
4. Roll the head and drop or swing the arms a little to increase flow of blood and relieve tenseness.
5. Increase the rate of speed, or the pace, in order to use different muscle groups. This is probably the most important aid in really combating fatigue. ("Checking out" of a slow pace.)

"CHECKING OUT"

Billy Hayes placed a great deal of emphasis on the mental relief a runner receives by the "checking out" process mentioned above. His runners used to break the "monotony of the pace" by a slight periodical change of form as they "sprinted when tired." Actually, the sprint merely increased the tempo of the steady pace they were running so as to relieve to some degree the muscles that were doing most of the work in maintaining the steady pace. Every distance runner who has had the courage to increase his pace when he was very tired admits he was mentally and usually physically relieved when he again settled back to race pace. The major problem is *getting* men to 'check out" when they are really tired.

The Europeans have long been exponents of "checking out," without actually publicizing what they have been doing. They usually run their long races by alternating the lead from one man to another. In the process of "lead changing," an increased pace usually results. As a result, the runners are mentally alert and the monotony and boredom of a constant, even pace is not present.

It must be mentioned, however, that "checking out" is done only for a few strides during a race and should not upset the total *even* pace that is the goal of every runner.

BREATHING

Much has been written and said on how distance runners should breathe. In fact, research shows that every possible means of taking in oxygen has been advocated at one time or another by the world's leading coaches. Three important points should remain in mind. The athlete should:

1. Breathe deeply.
2. Breathe regularly.
3. Inhale and exhale through nose and mouth together.

For those who can't seem to develop satisfactory regularity in breathing while running, it might help to try to inhale on two strides and exhale on two strides. This, however, is *not* essential, and most great runners don't have to think about breathing during a race. They simply breathe as deeply and as rapidly as is comfortable.

RUNNING ON THE FLAT

The technique of running on flat, level ground reveals the runner landing low on the ball of the foot, dropping down slightly on the heel, then rocking off the toe. Running flat-footed or heel first is, of course, inefficient and places a fatiguing jar on the body.

Cross-country runners must run with a *comfortable* style. Faults in form should be corrected in practice work. After the boy has worked on good form long enough, he will gradually find himself using his proper form automatically during competition. The athlete learns soon enough that the efficient, comfortable way to cover ground is with a short stride, a low, relaxed arm action and relatively low knee action. The coach constantly needs to remind the athlete to maintain these characteristics of good form even though he is getting tired.

RUNNING OVER ROUGH GROUND

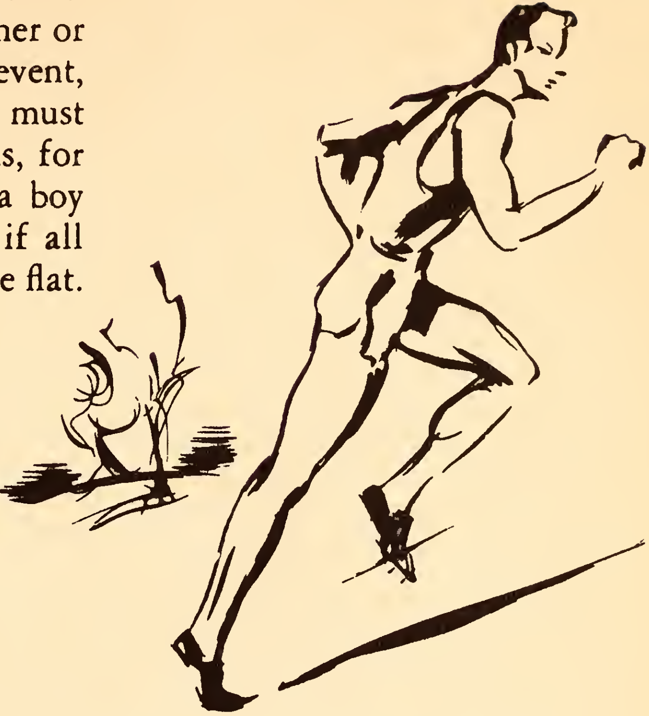
Rhythmic running over rough ground is very difficult, as control of balance is not easy to maintain. For this reason an even *shorter* stride is used when footing is uncertain. This shorter stride tends to keep the body weight more evenly distributed over the feet, and thus minimize spills and turned ankles.

When it is known that a very rough terrain is to be run, the athlete must take three precautions:

1. He must tape his ankles to prevent sprains and strains.
2. He must be particularly alert for changing ground surfaces.
3. He must wear a shoe with short spikes spread wide apart, or turn to the rubber-soled "flat."

RUNNING UPHILL

In going up a hill the runner must shorten his already short stride and lean farther forward. Some athletes use a more vigorous arm action, and experimentation by the individual runner will determine whether or not this technique helps. In any event, a great deal of practice time must be spent on running up the hills, for it is not reasonable to expect a boy to negotiate inclines efficiently if all his practice work has been on the flat.

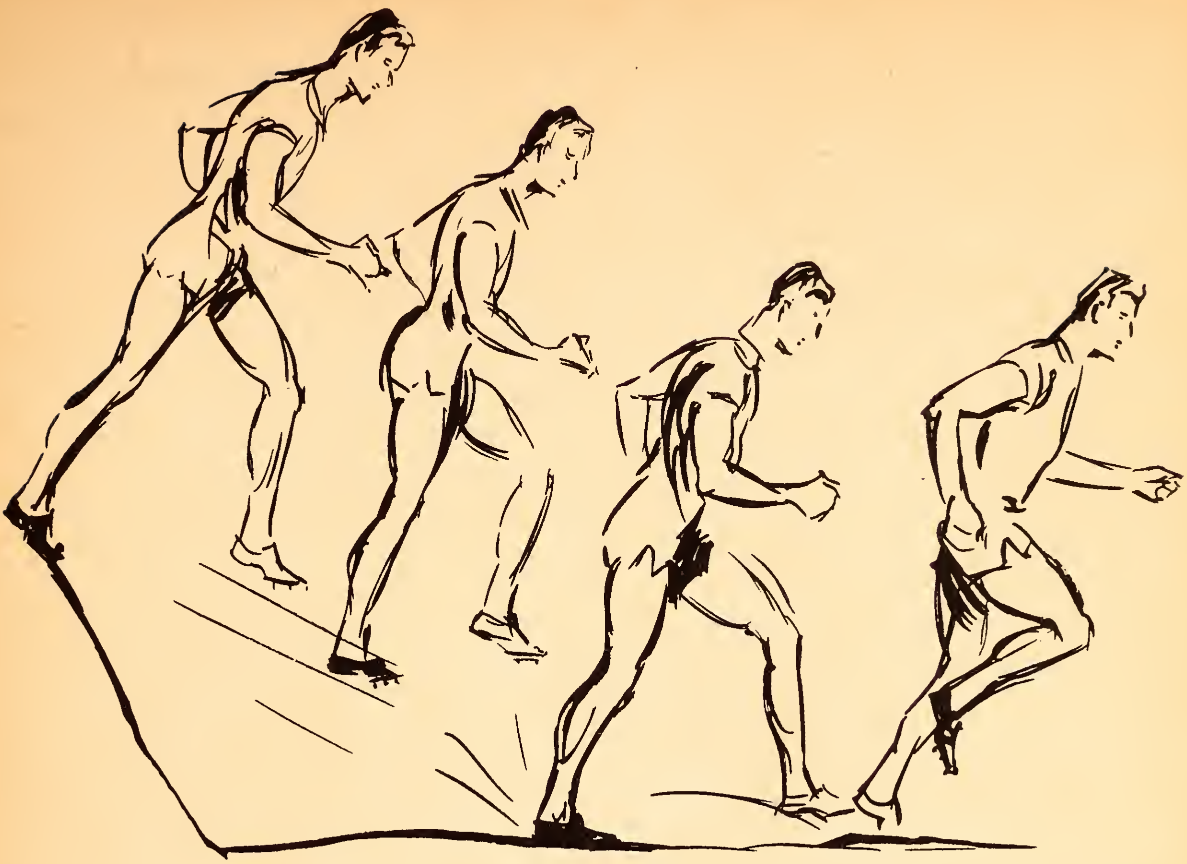


RUNNING DOWNHILL

In going downhill the opposite technique is used. The athlete must straighten his trunk to an erect position and drop his arms slightly. He must relax and allow his momentum to lengthen his stride. In a sense he should be coasting, allowing himself to go as rapidly as possible without exerting extra effort. The danger in going downhill too fast is in the severe heel jar the runner takes when landing. In addition, it has been found that it takes as much work and energy to go down a hill too fast as it does to go up. Downhill speed must be controlled. On approaching the flat the runner should gradually float into his usual pace. The running form on the flat parts of a cross-country course is the same as that used by a distance runner on the track.

GROUP RUNNING

The basic running philosophy in cross-country is teamwork. Many successful teams attempt to run in a group with the men giving each other encouragement. Running with a group of teammates will often help the slower man to better performance. Once it is realized that men simply do not run as well when strung out yards behind their teammates and competitors, the value of constant practice in group running at a strong meet pace is obvious. Group running need not necessarily work against the outstanding cross-country men. To make sure it does not, the pace for the group must be the ideal pace for the better men; then the slower men must attempt to carry it for close to three quarters of the race. During the last quarter the better men naturally continue to carry the faster pace, but usually this strong early pace has pulled some of the poorer men away from many competitors who might have beaten them had the group running not been attempted. Many successful teams run in two groups, with the same basic strategy in mind. This might be advantageous where team balance is lacking.

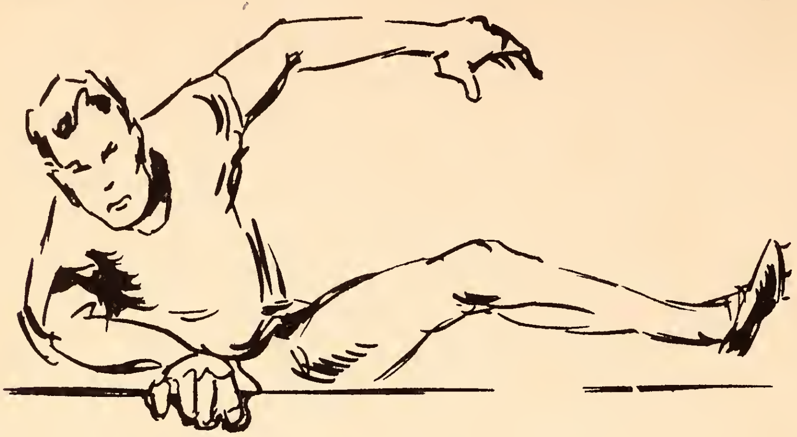


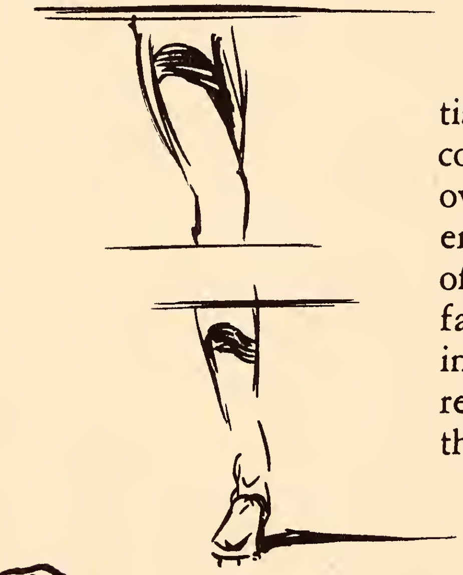
LANDING FROM AN EMBANKMENT

When individuals or groups must jump from an embankment or a surface higher than the next running surface, the danger of spills or turned ankles is great, especially with tired runners. From the European steeplechase runners, Americans have learned a valuable technique in landing that has prevented many falls and injuries. Instead of landing on the lead leg as is commonly done when jumping from a fence or bank, the Europeans land on the rear leg and rock into the step. This method provides great stability, because the landing shock is not taken by a tense first leg. The rocking forward into the next step then prevents breaking stride, as the forward momentum has not been checked. Landing with both feet together, of course, would check the forward momentum.

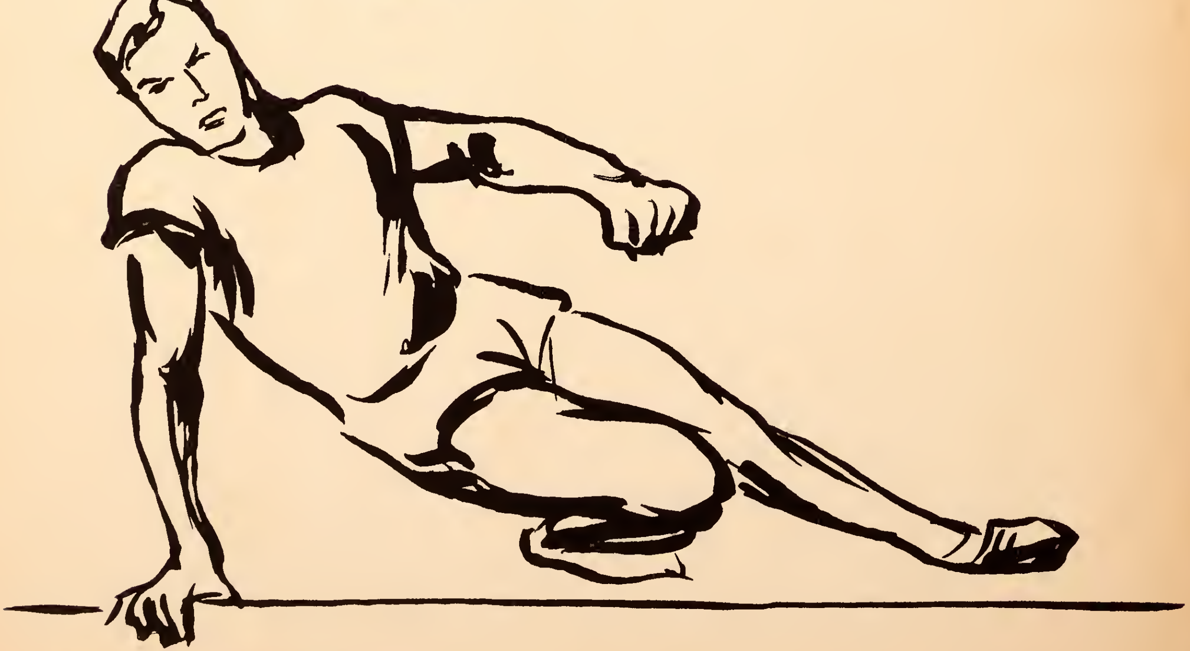
HANDLING OTHER SPECIAL PROBLEMS

Many coaches advocate running *through* ditches and streams where possible. It is felt this takes *less energy,* and a fall or loss of balance is not as likely as when the athletes are forced to jump.

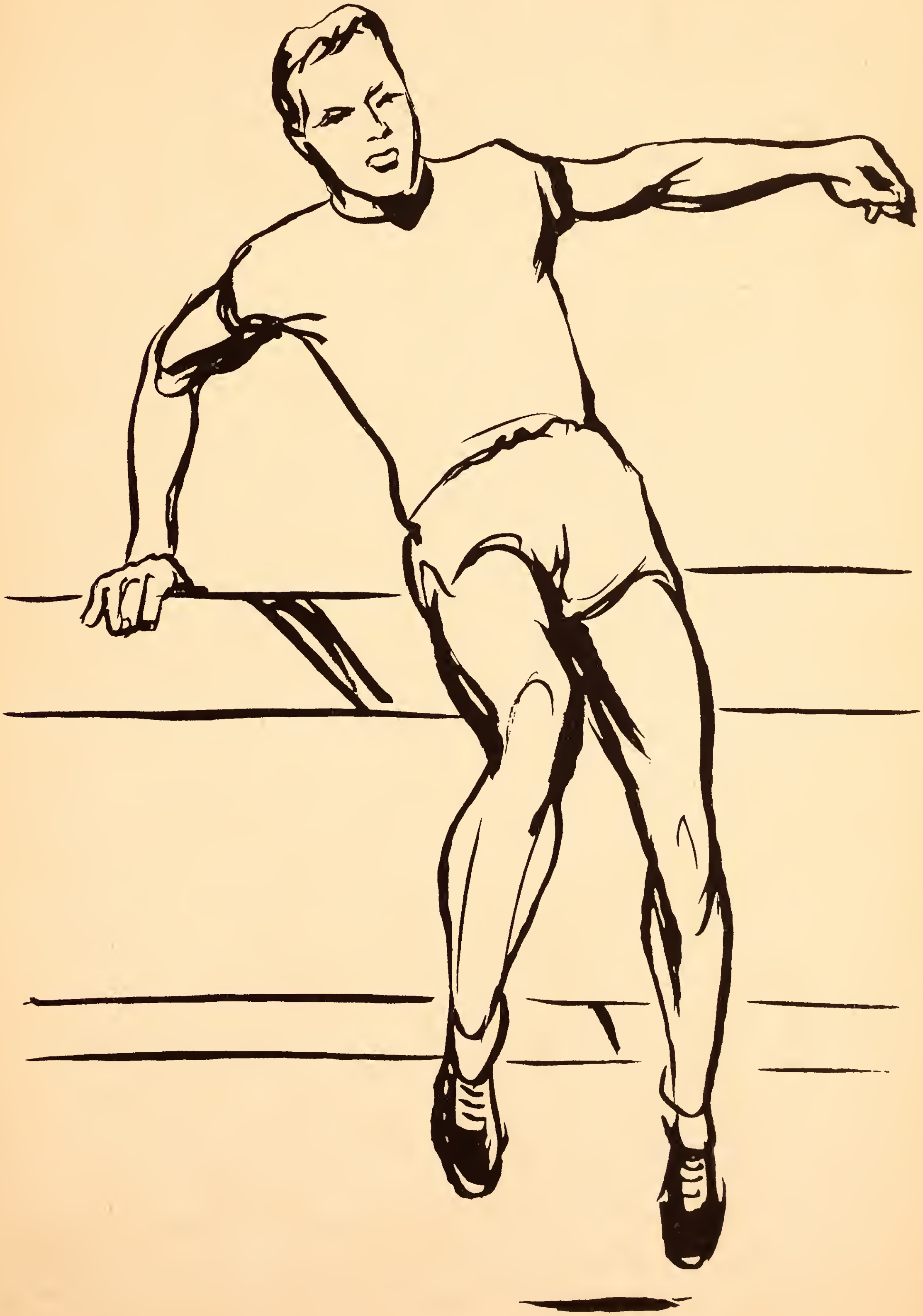




Where the runners must negotiate a fence during a race, many coaches advocate simply climbing over. They feel that it takes less energy, and that the loss of time is offset by the reduced possibility of falling. Where the fence occurs early in the race, when the athletes are relatively fresh, many coaches have their athletes employ a fence vault.



In coming off a fence, or some other object of similar height, the athlete must be sure that his knees are relaxed and slightly flexed to take the shock of landing. Where ground is very uneven and there is a danger of turned ankles, it is best to make a two-footed landing. Unless fence vaulting has been *practiced,* the athlete is safer to climb over. Even though valuable time is lost, a sprain or strain might be prevented.



STRATEGY

Psychology can play an important part in the final result of a long race. A smart runner (or group) can use devices which discourage the opposition. For example, once an individual (or group) is out of sight around a corner or over a hill, a faster pace should be attempted. Followers can very often become discouraged, on regaining sight of the runners ahead, by seeing that they have unexpectedly lost ground. This tactic repeated once or twice may cause the follower to forget the men in front and to start considering the men behind him. In passing a man, the athlete (or group) should always give the *impression* of being fresh. He should pass easily, carrying a slightly faster pace until he has built up a lead. It does no good to drop in a stride or two in front of the competitor; in fact, the latter's job is made easier when he can follow another's pace setting. Runners should not pass at all unless they are strong enough to carry a faster pace.

There is an additional advantage to running *close* behind an opponent. The man setting pace can act as a windbreak for the following runner. Intelligent athletes can also often take advantage of running close to hedges, fences and buildings which break wind for them, and in long races such simple conservation of energy is often a great factor in performance. It must be remembered that there is a pole lane in cross-country as well as on the track.

Where the field is large the athlete must assume that the first 200 yards or so of the race will practically be a sprint as athletes jockey for position. In fact, in most of the larger college meets, the first half mile of the race is usually run too fast. Realizing this and capitalizing on it is important. Not being drawn out too fast or too early and then making a move up through the field when the pace lags is the mark of the successful runner.

It should be mentioned, however, that when the major part of the race is to be run over a narrow trail where passing is very difficult, a different approach to the race has to be taken. In such a case the race can often be partially decided by the position in which the athletes go into the woods or trail. A sprint for position then is essential.

Where there is plenty of running room the athlete must not let himself be drawn into early fights for position. Racing with an opponent too early in a race often eliminates the chance of either man's performing up to capacity.

Concern over an opponent is natural, and there are few runners who can go out and run their own race regardless of who is running against them. When running behind another athlete, never watch his feet. Keep your head up and avoid thinking about the repetitious and monotonous pounding of the feet of the man ahead. When an opponent starts carrying his arms higher during a race it usually means he is getting tired. That is the time for a strong runner to pass him, and to bear in mind that a passing runner's feeling of fatigue must be disguised. Mentally, an opponent may be licked at that point. There are several other points that may be considered under strategy:

1. Flu or cold shots prior to the season often minimize the danger of losing a valuable man late in the season when weather gets bad.
2. The enthusiasm of the coach can go a long way toward developing pride and tradition among athletes.
3. An athlete should never quit a practice trial or a race of any kind. He may jog if necessary, but never stop until the finish is reached.
4. Gas pains can often be eliminated by trunk-twisting exercises, and following warm-up, twisting exercises should be taken.

The final strategy to be considered for cross-country running concerns itself with individual and team-meet preparation. Preparing for a cross-country race involves much more than just showing up.

THE DAY PRIOR TO THE MEET

1. Check over all equipment and change spike length and shoelaces if necessary.
2. Refrain from doing any hard, fatiguing work, and don't indulge in dancing or other activities that keep you on your feet.
3. Don't overeat, and stay away from all greasy foods.
4. Don't take a very hot shower that would sap your strength.
5. If a meet is away from home, travel to it on this day if possible, to avoid long, tiring travel the day of the meet.
6. Get at least nine hours of sleep in a cool room.

THE DAY OF THE MEET

1. Walk over the course two or three hours before the meet (if it is a strange site) to become familiar with terrain, turns and surface to be run.
2. Eat at least four hours before the race.
3. Report to the locker room about two hours before the meet for taping and last-minute details.
4. Never change a "warm-up" program on meet day. Use the one that has been used all season.
5. Refrain from taking squats or heavy exercises that tend to tighten the legs and thighs.
6. Get the team together before the race and emphasize again that a team effort is necessary for success.

Chapter VII

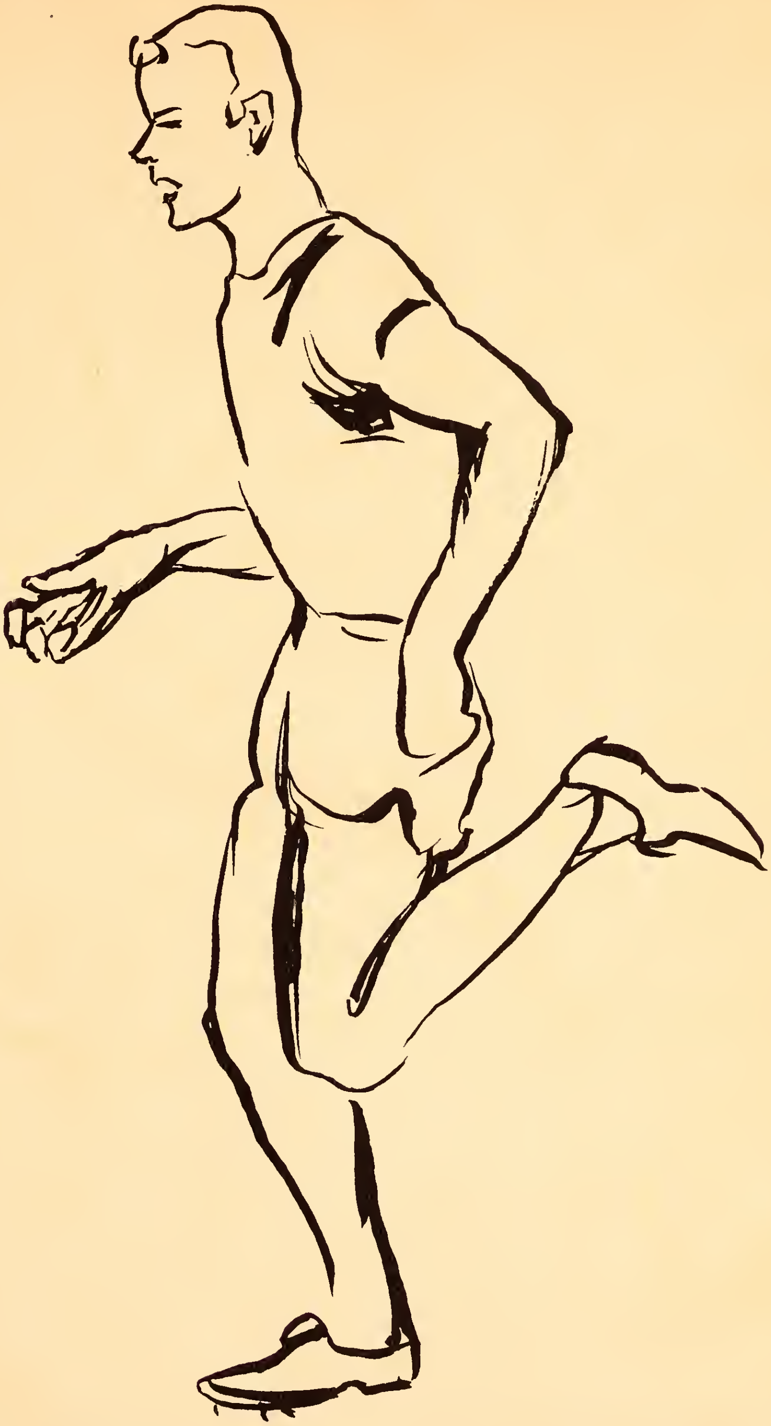
EUROPEAN CROSS-COUNTRY METHODS

When we consider the great number of world and Olympic champion distance runners who have come from European countries, it seems wise to carefully investigate their training methods. Champions are *never* accidents, and when runners like Paavo Nurmi (Finland), Gunder Haag (Sweden), Arne Anderson (Sweden), William Slijkhuis (Holland), Emil Zatopek (Czechoslovakia), Gaston Reiff (Belgium), Viljo Heino (Finland), Henry Eriksson (Sweden) and Joseph Barthel (Luxemburg) appear year after year on the European scene there is a reason for it. These runners not only dominated the world, but they were so far in advance of our great distance runners that the meetings on the track were usually no contests. It has been only in the rarest of instances that we have been able to defeat Europe's best distance runners.

Much has been written and said concerning European distance-training techniques.

RUNNING FORM

From the standpoint of form or style, it is evident that European distance and cross-country runners believe in a shorter stride than the average American runner uses. Fred Wilt explains this by saying, "Europeans simply feel it *easier* and *faster* to take two short steps than one long step in racing all of the distances from the half mile to 10,000 meters." In addition, we find the form technique of most European distance runners emphasizing a higher back kick and a lower knee action, since they feel less energy is required in bringing the leg through and forward with this method. Most American coaches agree, however, that the longer the race the shorter the stride, and thus the lower the knee action. Due mainly to our great emphasis on shorter races and a great amount of speed work, our average American runner does not usually carry as short a stride and as low a knee action as the European.



The European long-distance runners almost without exception run with a high back kick, as shown above. Their theory is that the lower leg will swing down and to a forward position with a pendulum action that does not require the athlete to expend energy lifting it forward. The Europeans' very low knee action is thus practical, since the pendulum action of the leg makes a high knee action unnecessary. Their lack of hard constant speed work on the track, such as most American runners practice, also tends to prevent development of higher knee action.

Constant running on soft surfaces tends to keep the leg muscles of foreign runners in a soft condition. Landing *very low* on the ball of the foot and deep stretching massage following meets or practice also assist them in keeping a soft, relaxed muscle. American distance runners who run at shorter distances than their European counterparts need more speed and, consequently, develop a harder muscle by their repeated work on the track.

Europeans in general also tend to disregard arm action if the runner feels comfortable. Zatopek, by our standards, has poor arm action. He not only carries his arms high and very tense, but also swings them across the body to a greater extent than American coaches advocate. It must, however, be a comfortable and efficient arm carry for Zatopek. While we see a slight difference in European style in form technique, it must be remembered that individuals differ widely, and that form alone never made a distance runner.

The appearance of a shuffle given by some Europeans results from their very short stride over *long* distances, plus their low, *almost* flat-footed striding. Recently, some American cross-country runners have shortened their strides and claim that their running is now coming more easily. An almost erect running position will often shorten stride and usually will eliminate long bounding strides. An erect position causes a runner to land *lower* on the ball of his foot.

One of the most striking qualities seen in almost all European distance runners is their ability to carry remarkably fast pace, while appearing completely relaxed. Zatopek (who is usually tense) has given many the wrong impression of foreign runners. Unlike the great Zatopek, most of the better Europeans usually hold their form from start to finish, and even after extreme fatigue has set in they have the ability to stay "loose."

"SPEED-PLAY"

Mr. Gosta Holmer, the Swedish Olympic coach, has done a considerable amount of intelligent writing for American consumption, and it is his opinion that the European training technique (particularly the Scandinavian) is the secret of European distance-running success.

The cross-country season in most European countries is started in December, and meets are usually held during April and May. The track season begins in June and runs until October. It is of interest and possible significance, however, that throughout the year most of the athlete's work is done on a cross-country course rather than on the track. Even at the height of the track season Europeans spend most of their time on soft, springy surfaces.

The most successful method of European training is called Fartlek (meaning speed-play) and it was designed by Gosta Holmer. His main points on this system are:

1. The running should be done on a cross-country course where the surface is soft and springy.
2. The athlete should run for periods of time rather than at specific distances, in an effort to turn his mind from the stop watch to concentration on his own creative efforts in experimenting with his endurance.
3. The athlete should not get completely fatigued, but should feel stimulated after the workout.
4. He should *always* end the workout by running some *pace work* on the track.
5. Once each week he should take a two- to four-mile walk on the cross-country course to rest and recuperate from any mental or physical strains of running.
6. The athlete should train from *one* to *two* hours each day. The following schedule may be repeated several times during a single workout or may be run fewer times during two different training sessions during the same day.
   (a) Easy running from five to ten minutes (as a warm-up).
   (b) Steady, hard speed for one to two kilometers (¾ mile

to 1¼ mile).

(c) Rapid walking for about five minutes.

(d) Easy running with three or four swift steps now and then. (In reality, these swift steps would be like the sudden speeding up of a runner during a race when he tries to fight off a challenger who is trying to pass him. The body suddenly lurches forward, and three or four quick, sudden steps are taken.)

(e) Running full speed uphill 150 meters to 200 meters (175 to 220 yards).

(f) Fast pace for one minute following this trial of strength described in (e).

(g) Return to the track for pace work.

ADVANTAGES OF "SPEED-PLAY"

The advocates of *Fartlek* or speed-play list the following advantages of this technique.

1. It prevents boredom and, to an extent, staleness, because it emphasizes recreational running (speed-play).
2. The runner gets to learn his own ability. He doesn't tie himself up on a certain task (such as a run of two English miles on the track, or three separate 220-yard sprints at a certain pace), but is forced to explore. It is not the fixed courses that make a professor out of a student, but the student's spirit of exploration, his studies of other explorers and his friendship with them. It is the same thing with an athlete. *Fartlek* is such a field of investigation.

   Fartlek is rich in contests, richer for the athlete with creative power and an ability to decide where the limit of his strength is; that is to say, the ability to decide for himself when the training is no longer improving him, but is destroying him instead.
3. It keeps muscles soft and pliable because the athlete is not pounding a hard surface day after day in training.
4. It provides both speed and endurance training during one workout.
5. It is stimulating rather than fatiguing, as the individual (not the coach) determines when he has had sufficient running.

OTHER FACTORS

That there are advantages to *Fartlek* and other similar methods of training cannot be denied. A little investigation, however, might indicate that there are other factors besides training methods that lead to European long-distance-running success. It appears that *age, national emphasis* on distance running, *meet programs* and even *climate* better explain European success.

It is a well-known fact that the Europeans reach their peaks from four to ten years after our boys have stopped running. For instance, at their peaks, Zatopek was twenty-nine years old, Hansenne was thirty-four, and Reiff was thirty-two. This is no doubt due to the great national emphasis that is placed on the distance runs, for the athletes simply tend to stay with it longer. In Europe the national hero might well be the 5,000- or 10,000-meter champion. Here, however, our attention seldom turns to a man who excels at six miles.

In America we seldom find the five- and ten-thousand-meter runs on our programs; in Europe these are very popular races. Our emphasis is on the middle distances and our most popular long-distance race is only two miles on the track.

Fred Wilt feels that weather plays an important part in European distance-running success. He claims it is much too hot here when we hold our big meets, and points to the fine performances given by Americans in the cooler Scandinavian countries.

At any rate, the situations present different problems for each continent, and it should not be surprising to find different methods of training. *For these reasons it seems that the European methods of training are only partially responsible for their great success in distance running.*

CONTRASTING TECHNIQUES

It is interesting to note the great amount of "speed-play" in the European program. The lack of supervision is also of interest, as both points indicate a fundamental difference in coaching theory.

Contrast the "speed-play" on the cross-country course with our speed work on a track and it should be evident that we place much more emphasis on real speed. It is just not possible, by our standards, to cover ground as fast on grass as it is on boards or cinders, and practically all of our distance runners do speed work on the tracks during cross-country and spring track seasons.

The Europeans also place much less importance on supervision of the actual workout than Americans do. This is no doubt due to the fact that their leading athletes are *older* and more *experienced.* When they refer to "hard running," for instance, they assume the athlete knows what it is to draw himself out. Our youngsters usually have very little experience, and the lack of supervision does not seem practical for most of our athletes.

While Europeans often train away from the coach, Americans usually spend four or five days a week in supervised work at fixed distances, both over or under the individual's meet distance. The Europeans train for a specific period of time; we tend to train at specific distances. We are not concerned with working over soft surfaces, and we do a good amount of work that does not always leave a boy fresh at the end of practice.

BASIC DIFFERENCE IS APPROACH

The approach to the work in developing distance runners appears to be the basic difference between the two systems. The Swedes, for instance, are not likely to draw a man out deliberately at any distance in a practice session. On the other hand, we believe that a certain amount of hard, fatiguing work at specific distances is necessary for our program. We feel that distance-running success is determined by the ability to withstand fatigue by training, and until a *youngster* goes through *degrees of fatigue* with a coach's guidance, he is not experienced enough to realize what his abilities are. *Fartlek,* without a doubt, is a slower method of developing athletes, and for this reason probably is not the most effective method for us, since our boys must reach championship stature in a few short years.

Another point of difference in the two methods of training concerns itself with muscle development. The Swedes believe in soft muscle development, and running on soft springy surfaces tends to keep the leg muscles soft.

Americans, as mentioned, place the emphasis on speed work, and that just cannot be done as well on soft surfaces. Speed work, of course, develops a harder muscle which we accept as long as we can keep the boy relaxed. You must sacrifice one for the other, and Americans prefer the speed while the average European prefers the soft muscle. In this case again the needs of each program seem to dictate the training methods, since our youngsters train for shorter cross-country and distance races than are usually run by the Europeans.

Fartlek, in particular, is a program which leaves a great deal up to the individual. It leads the runners to explore and develop their own resources, and seems to be fine for mature men who must practice alone without teammates or coaches. Men such as Wilt, Stone and Ashenfelter have turned to it with success, but it is possible that these men would be running just as well or better under only their former methods (with their present maturity and added running experience). *Fartlek,* however, does seem to solve a problem for exceptional cases, and especially for the youngster who is forced to work alone.

SUMMARY

In summing up, then, it would seem a mistake to train most of our youngsters exactly as the average European is trained.

We are faced with the problem of getting a boy to reach his peak at a much earlier age than is required in Europe. While such systems as *Fartlek* may be quite sound, they are designed to meet problems of a different nature, and only in isolated cases do they apply in this country.

America will probably never *dominate* the long-distance races because our *national interest* doesn't lean that way. America is, however, turning out more fine high-school and college distance runners than ever before, and the trend will no doubt continue. Although we may never really know, most American coaches feel that our distance runners would match the best of the Europeans if they continued to run until their distance-running maturity of twenty-eight or thirty years of age. Men like Lash, Rice and Ashenfelter have given weight to these arguments.

GLOSSARY

A.A.U.—Amateur Athletic Union.
BALL-HEEL-BALL—The manner in which distance runners touch the foot to the ground while running.
BOTTOM—Basic conditioning or basic stamina.
CENTER OF GRAVITY—The point on which the body can be balanced.
CHECKING-OUT—Changing monotonous pace by running a little faster.
CHUTE—A pen or enclosure to aid in judging finishes.
CO-ORDINATION—Well-adjusted and efficient muscle movements.
DRIVE LEG—The leg exerting the force during the stride.
ENDURANCE—Strength and ability to perform work over a long period.
FARTLEK—Swedish method of training distance runners.
FLAT—Level ground.
FLAT-FOOTED—Landing on heel and ball of foot simultaneously.
FLATS—Track shoes without spikes.
FRONT RUNNER—One who can run well, leading and setting the pace.
GATHER—To compose for additional greater effort.
HARRIER—A cross-country runner.
HEAD WIND—Wind blowing against the runner's course.
INTERCOLLEGIATE—Competition between institutions at the college level.
INTERSCHOLASTIC—Competition between institutions on the secondary level.
JOGGING—Running at a very slow pace, with a short stride.
KICK—Leg speed used at the end of a race.
KICKER—A runner who depends upon kick to win.
KICKERS, TEAM—The sixth and seventh men on a cross-country team where only five men actually score.
MARKS—An athlete's starting point for a race.
METER—39.37 inches.
MOMENTUM—Force possessed by an athlete in motion.
N.C.A.A.—National Collegiate Athletic Association.
N.F.S.H.S.A.A.—National Federation of State High School Athletic Associations.
OFF-DISTANCE—Any distance other than the actual meet distance.
OVERDISTANCE—A distance greater than meet distance.
OVERSTRIDING—Running with a stride longer than practical.
PACE—The rate of covering ground while running.
PULLED MUSCLE—Muscle fiber that has been pulled apart.
PUSHER—A chamois-toe sock.
REACTION TIME—The time between gun sound and the first move.
RECOVERY LEG—The nondriving leg during running.
REFLEX—An automatic and involuntary muscle reaction.
RHYTHM—Uniform, well-co-ordinated running action.
RUNNING ROOM—The space between athletes to eliminate danger of bumping during the race.
SECOND WIND—The sudden sensation of feeling fresh during a race.
SHIN SPLINTS—Sore shin bone muscles.
SPEED-PLAY—The Swedish method of doing speed work on a cross-country course.
SPRING—Bounce or lightness of foot.
STEEPLECHASE—A race involving a water jump and hurdles.
STRIDE—The distance covered by a leg cycle while running.
TECHNIQUE—Form used to execute an action.
TIMING—Co-ordination between various body movements.
TYING-UP—Overtenseness due to extreme fatigue.
UNDERDISTANCE—Distance less than meet distance.
UNDERSTRIDING—Running with a stride that is too short to be efficient.
VELOCITY—Rate of motion.
WIND SPRINT—A practice sprint for developing and conditioning the wind and legs.

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